HEATHKIT® MANUAL

Heathkit® Manual

for the

HIGH SPEED
PRINTER
Model H-25

OPERATION   595-2555-01

616 — 982-3889

FCC REQUIREMENTS

WARNING — This equipment is marketed pursuant to a waiver of FCC Rules Part 15 Subpart J. Operation of this computer in a residential area may cause objectionable interference to radio and TV reception, because it emits more radio frequency energy than FCC Rules allow. If interference occurs, the user will be required to take all steps necessary to correct the interference.

If this equipment does not cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Move the computing device away from the receiver being interfered with.

- Relocate the computing device with respect to the receiver.

- Reorient the receiving antenna.

If additional help is needed, consult the dealer or ask for assistance from the manufacturer. Customer service information may be found on the inside back cover of this manual or on an insert sheet supplied with this equipment. The user may also find the following booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the US Government Printing Office, Washington, D.C. 20402 — Stock No. 004-000-00345-4.

Additional "corrective action" statements to be used, when applicable, include: (Check with engineer or Reg. Compl. Lab)

- Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.

- Disconnect and remove any I/O cables that are not being used. (**Unterminated** I/O cables are a potential source of high RF emission levels.)

- Unplug and remove any serial I/O circuit board cards that are not being used. (Here again, **unterminated** cards can be a source of potential interference.)

- Be certain that the computing device is plugged into grounded outlet receptacles. (Avoid using A/C cheater plugs. Lifting of the power cord ground may increase RF emission levels and may also present a lethal shock hazard to the user.)

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TABLE OF CONTENTS

INTRODUCTION

The Heath Model H-25 High Speed Line Printer is a computer peripheral that provides computer read-outs in hard copy form. The Printer uses an inked ribbon and an impact-type print head to print a dot matrix on regular paper. The following features make the Printer very versatile:

- Both upper and lower case characters.

- Full 95-character ASCII font.

- "Paper out" and "jammed" detectors that prevent damage and loss of data.

- Cartridge ribbon for long printing life and "no mess" replacement.

- Heavy duty mechanical construction for continuous operation.

- Block graphic capability.

- 9 × 9 matrix for high quality print with descenders and underlining.

- 12 × 9 matrix for graphics.

- Completely enclosed cabinet for reduced sound levels.

- 10, 12, 13.2, and 16.5 characters per inch.

- Microprocessor controlled functions and timing.

- Either RS-232C or 20 mA current loop serial interface (user selectable).

- Handshake control signals.

- Electronic form controls.

- Adjustable vertical and horizontal tabs.

- Up to 6-part form printing capability.

The modern design assures excellent reliability, and the handsome styling compliments the Heath/Zenith Computer Series.

NOTE: This Manual contains three major sections for operation and servicing. The "Operating Instructions" section contains information for the nontechnical operator. The "Technical Operations" section contains information of a more technical nature and shows you how to set up the Printer, connect it to your Computer, and determine whether a problem is in the Printer or in some other part of your system. The "Service Information" section is for the advanced technician and provides you with information for troubleshooting the Printer circuits. At the rear of this Manual is another section which lists all of the specifications for the Printer.

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PERMANENT SETUP

When you select the operating position for your Printer, consider the following factors:

1. Provide an easy path for the paper. There should be no sharp edges that could cause the paper to tear. Also provide space for the paper where it will be safe and clean.

2. Place the Printer where it will be safe and in a clean atmosphere and where the printing noise will not bother other persons.

3. Be sure to allow at least 3″ of space on the left side of the Printer for air circulation.

4. If you will be frequently changing the format and communication protocol switches on the rear panel, try to provide access space for these switches.

OPERATING INSTRUCTIONS

This section of the Manual is written especially for the nontechnical user. It shows you how to operate the Printer as you would on a routine basis.

CARING FOR THE PRINTER

For continued trouble-free operation from your Printer, be sure to use the same care as you would for any other fine piece of office equipment.

Be sure the Printer has adequate ventilation. Keep all objects at least 3″ away from the vent slots on the left side of the cabinet.

Do not expose the Printer to unusual amounts of moisture. Use special care that you do not spill any type of liquid onto the Printer.

CONTROLS AND INDICATOR LIGHTS

The main POWER switch for the Printer is located on the rear panel (see Pictorial 1-1).

POWER SWITCH
OFF (DEPRESSED)

PICTORIAL 1-1

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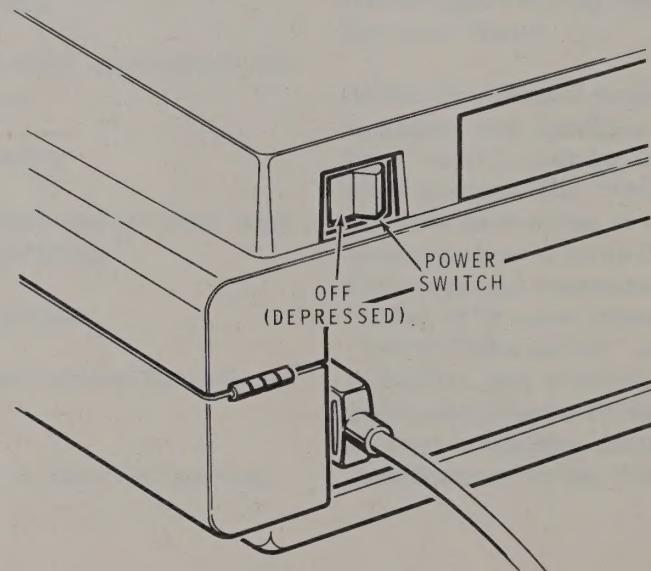
Refer to Pictorial 1-2 for the locations of the following switches and indicator lights that are mounted on the control panel:

TOP OF FORM switch: Press and release the TOP OF FORM switch whenever you wish to advance the paper to the top of a new form (page). Whenever the Printer is turned on, the current paper position is assumed to be at the top of a form with the page length as set by the switches on the rear panel of the Printer. (See Pictorial 1-3, Illustration Booklet, Page 1). This function is operative only when the Printer is "OFF LINE." If the "TOP OF FORM" position does not correspond to the desired top of a form, use the FORMS ALIGN switches to position the paper as desired. (See Pictorial 1-4, Illustration Booklet, Page 2).

FORMS ALIGN switches: Use these switches to move the paper in the direction of the arrows. When you momentarily push one of these switches, the paper moves .021 inches and stops. Hold the switch down to move the paper one line at a time. NOTE: These switches operate only when the Printer is "off line."

POWER indicator: Lights when the POWER switch on the rear panel is ON.

ON LINE indicator: Lights when the Printer is ready to receive information.

PAPER indicator: Lights when the Printer is out of paper or the paper is jammed.

FAULT indicator: Lights when the printer unit (inside the Printer) is open, the carriage is in an over-travel condition, or the printer circuits are over-heated.

RESET switch: Use this switch to reset the alarm and restart the Printer. NOTE: You will normally use this switch after you correct an out-of-paper, paper jam, or fault condition.

ON/OFF LINE switch: Alternately places the Printer in an on-line or an off-line condition. In the on-line condition, the Printer will accept data. In the off-line condition, the Printer will not accept data. NOTE: The three "form" switches operate only in the off-line condition.
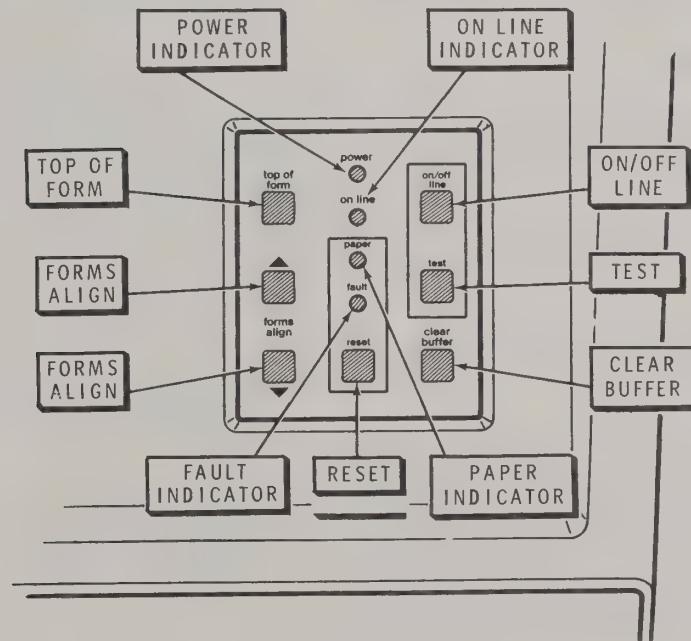
PICTORIAL 1-2

TEST switch: This switch allows you to test the operation of the Printer. NOTE: The Printer does not need to be connected to a computer to perform this test. To perform the test, use 14-7/8″ × 11″ paper.

1. Push the ON/OFF LINE switch until the Printer is off line (ON LINE indicator not lit).

2. Press and hold down the TEST switch. Do not release this switch until a step directs you to do so.

3. Press and release the ON/OFF LINE switch.

4. Release the TEST switch. The Printer will print a "barber pole" pattern which consists of all the characters the Printer can print.

5. To cancel the test, push the ON/OFF LINE switch to place the Printer in an off-line condition.

CLEAR BUFFER switch: Push and hold this switch (for less than 1/2 second) to clear the Printer's internal buffer. If you wish to print the contents of the buffer, push and hold the switch for more than 1/2 second.

If you have already installed the paper and ribbon cartridge in your printer, proceed to the appropriate interface section on Page 10 or 13.

INSTALLING THE PAPER

Refer to Pictorial 1-4 (Illustration Booklet, Page 2) and use the following procedure to load the paper into your Printer:

1. Raise the front of the cabinet top until it is fully open.

2. Release the latches on each side of the printer unit. Then open the printer unit.

3. Route the free end of the paper through the slot in the bottom of the cabinet. NOTE: Although the paper may be routed under the cabinet from the front of the Printer (as shown in dashed lines), we recommend that you position the paper directly below the cabinet slot. The paper must move as freely as possible to avoid jams.

4. Open the paper hold-downs on the four tractor drive assemblies. Pull down on the locking lever and move the left tractor drive approximately 1″ from the paper out/jam detector, then engage the locking lever.

5. Push the sprocket holes in the left side of the paper onto the lower left drive sprocket and close the paper hold-down.

6. Place the sprocket holes in the right side of the paper onto the lower right drive sprocket and close the paper hold-down. Use the locking lever to reposition the drive sprocket as necessary to fit the width of the paper. NOTE: When properly positioned, the paper should fit the spacing of the drive sprockets without being tight or having any kinks.

7. Reposition the top left and right tractor drives as necessary to fit the drive sprocket holes in the paper and close the paper hold-down. Make sure you engage the locking levers afterwards.

8. Adjust the spacing between the top tractor drive and the lower tractor drive to properly fit the paper. To do this, turn the thumbscrew on each side of the carriage. The paper should fit the spacing of the sprockets so the sprocket pins are centered in the paper holes.

NOTE: If you are unable to properly align the sprockets with the sprocket holes as instructed, reset the thumbscrews to the center of their adjustment, then loosen the setscrews on the paper drive motor pulley and rotate the upper drive shaft until they do align; then retighten the setscrews securely.

9. Lower the printer unit and resecure the latches.

10. Manually turn the top right pulley and position the top edge of the **second** sheet of paper as desired.

11. Route the paper through the slot in the rear of the cabinet. Pull forward on the support arm to release the detent. Then close the Cabinet top.

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INSTALLING THE RIBBON CARTRIDGE

Refer to Pictorial 1-5 (Illustration Booklet, Page 3) and use the following procedure to install the ribbon cartridge:

1. Raise the cabinet top to its fully open position.

2. Release the latch on each side of the printer unit. Then open the printer unit.

3. Start the hook on the cartridge bracket into the left side of the cartridge. Then lower the cartridge onto the ribbon drive motor spindle in the printer unit and secure it with the cartridge spring. Be sure the ribbon is between the print head and the ribbon shield. Turn the knob on the ribbon cartridge in the direction of the arrow to engage the ribbon motor drive shaft.

6. Close the printer unit and secure the two latches.

7. Pull forward on the support arm to release the detent and lower the cabinet top to its fully closed position.

INTERFACE (HARDWARE) REQUIREMENTS

Your Printer communicates with your computer through a serial I/O interface at RS-232C signal levels. The 25-pin "D" connector on the rear panel of the Printer conforms to RS-232C standards and it will mate with most equipment that conforms to this standard. Refer to Pictorial 2-1 for the interface cable pin connections. The cable which you were supplied with your Printer will interconnect pins 1 through 7, 11, and 20 straight through. The following information describes the setting and functions of the rear panel switches.

Refer to Pictorial 1-3 (Illustration Booklet, Page 1) and set the jumpers on the logic circuit board (inside the Printer) as shown.

Refer to Pictorial 1-3 and set the switches on the rear panel of the Printer as follows:

1. BUSY POLARITY switch to 0 (low when busy).

2. PARITY switches to 00 (none).

3. BAUD switches to 110 (4800 baud).

4. ETX/ACK switch to 0.

5. DC1/DC3 switch to 0.

NOTE: Since many of the rear panel switches are explained clearly on the rear panel of the Printer, only the following rear panel switches will be explained. Setting switch to "1" activates the selected function:

6. LIMIT FORM FEED — When this switch is activated, it prevents a form feed if the paper is already at the top of the form.

7. DISCARD PAST END OF LINE — This switch causes all characters between the set line length and a line terminator to be discarded. NOTE: A line terminator is a CR, LF, or FF.

8. A and B — These switches are reserved for possible future expansion of your Printer.

9. AUTO LINE — This switch causes a line feed to be executed whenever a carriage return is received.

NOTE: The rear panel switches marked with a dot (.) are not used. Changes in the DIP switches will not become effective until the rear panel reset button is pressed, or the Printer is powered down.

Connect one end of your interface cable to the Serial I/O connector on the rear panel of the Printer.

NOTE: TO MEET FCC INTERFERENCE REQUIREMENTS, YOU MUST USE A SHIELDED-TYPE CABLE. THE SHIELD MUST BE BONDED TO THE CHASSIS AT BOTH ENDS.

PICTORIAL 2-1

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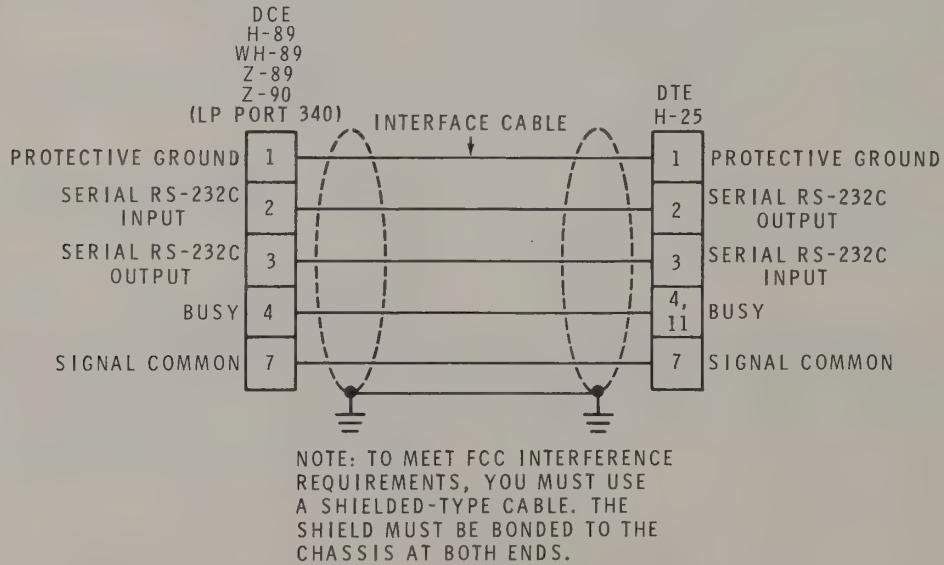
HEATH/ZENITH SYSTEM CONFIGURATION

H-89/WH-89/Z-89 Hardware Configuration

NOTE: You must have a Serial Interface Card; Model H-88-3, HA-88-3, or Z-89-11; installed in your Computer.

1. Refer to Pictorial 2-2 and connect the free end of the cable coming from your Printer to Port 340Q (Port P1 on earlier Models) of your computer.
2. Set the interrupt jumper for Port 340Q on the serial interface card to OFF:

Proceed to "Heath/Zenith Software Configuration."

PORT 340

SERIAL INTERFACE
CIRCUIT BOARD
H/HA-88-3

PORT 340
INTERRUPT
JUMPER

OFF

340

5-4-3 OFF
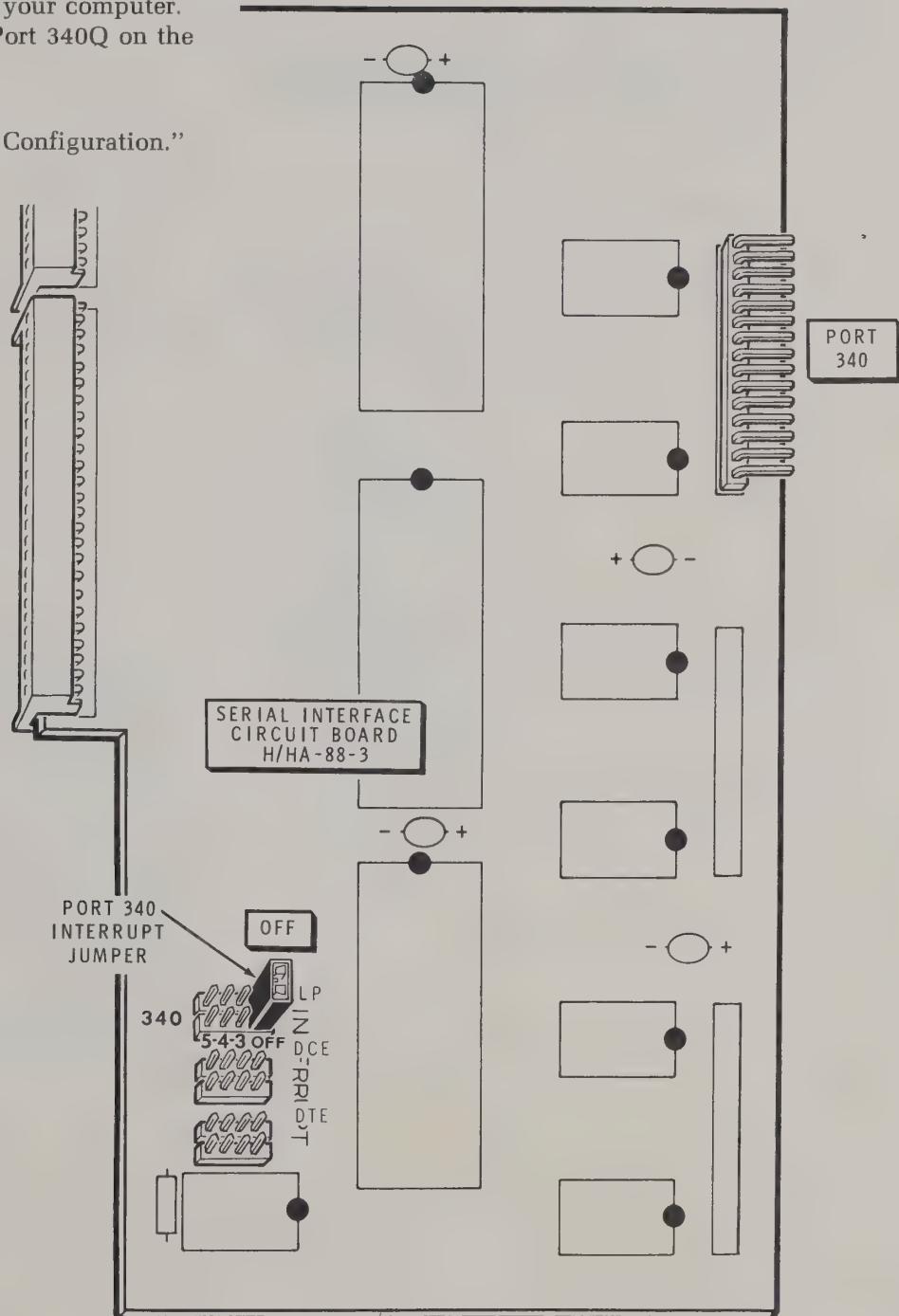
PICTORIAL 2-2

H-8 Hardware Configuration

NOTE: You must have a Serial Interface Card, Model (W)H-8-4 or Model WH-8-47, installed in your computer.

Refer to Pictorial 2-3 (Illustration Booklet, Page 4) for the following steps. NOTE: Pictorials 2-3 and 2-5 (Illustration Booklet, Page 5) show channel 1 set for 340 with the interrupt jumpers set to OFF. You may use another channel if you prefer.

1. Refer to Pictorial 2-5 (Illustration Booklet, Page 5) if you have an (W)H-8-4 card installed.

2. Jumper the port for address 340Q.

3. Jumper the interrupt to off.

4. Refer to Pictorial 2-4 (Illustration Booklet, Page 4) and connect the free end (DTE connector) of the cable coming from your Printer to an RS-232 cable coming from the DCE connector of the serial I/O card (jumpered port).

HEATH/ZENITH SOFTWARE CONFIGURATION

HDOS: Use the H-25 (LPH25.DVD) device driver. Rename it to "LP.DVD" and set the LP to baud 4800. If LPH25 is not available, you may use LPH24.DVD, but it must be patched. See Appendix 1 (Page 65).

If you use the Printer from the HDOS command mode, configure it as follows:

```
COPY LP:=LPH25.DVD

    - or -

PIP LP:=LPH25.DVD
```

CP/M: Run the CONFIGUR program.

Select the "Set Terminal and Printer Characteristics" menu and set the baud rate for the logical device LST to 4800.

C LST: Baud rate 4800. Port: 0E0H=340Q
M   Printer Ready Signal polarity <high, low>: High.
N   Printer Ready Signal <DTR (pin 20), RTS (pin 4)>: RTS

Return to the main menu.

Select the "Change Default I/O Configuration" menu.

Assign the physical device LPT to the logical device LST.

D LST: =LPT: available TTY: CRT: LPT: UL1:

When you use the Printer from the CP/M command mode:

```
LIST FILENAME

    - or -

PIP LST:=FILENAME

    - or -

PIP LPT:=FILENAME
```

The previous procedure is for CP/M versions 2.2.03 and later. Earlier versions do not support user selection of handshaking polarity. If you use the Z-25AA with an earlier version, reverse the polarity of the signal coming from the Printer by setting the rear panel DIP switch SW202, labeled BUSY POLARITY (6), to the 1 (up) position. Then push the rear panel RESET switch, and run the CONFIGUR program to insure that the baud rate is set to 4800 and the LST: device is assigned to LPT:. In this case, the Z-25AA will act like an H-14 or WH-24 type printer.

This completes the "Heath/Zenith System Configuration." Proceed to "Programming" on Page 20.

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NON-HEATH/ZDS SYSTEM CONFIGURATION

This Printer is designed to interface with serial I/O modules that use the RS-232C standards of the Electronic Industries Association (EIA). This standard defines an asynchronous serial interface, its voltages (see Pictorial 2-6), its impedances, and its physical connectors.

RS-232C places all equipment into one of two general categories:

DTE--Data Terminal Equipment
DCE--Data Communications Equipment

Computers and MODEMS are two types of DCE, while terminals, printers, and most other peripherals are DTE. Always connect a DTE to a DCE. Never connect two like types together.

MAX. OPEN-CIRCUIT
DRIVER VOLTAGE (+25)

+15

SPACE/ON

+3

MAX. OPEN-CIRCUIT
TERMINATOR VOLTAGE (+2)

TRANSITION

MIN. OPEN-CIRCUIT
TERMINATOR VOLTAGE (-2)

-3

MARK/OFF

-15

MIN. OPEN-CIRCUIT
DRIVER VOLTAGE (-25)
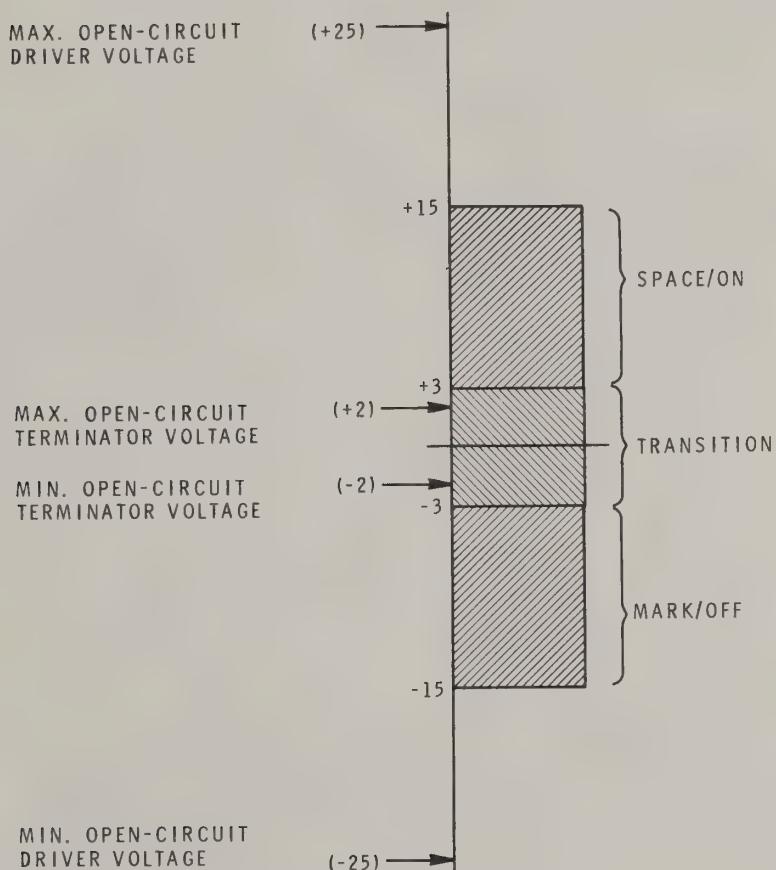
PICTORIAL 2-6

The 25-pin "D" connector on the rear panel of the Printer is a DTE (DB-25P) connector. Refer to Pictorial 2-7 and modify your interconnect cable, if necessary, for the DTE pin output of your computer's connector.

Make sure your serial I/O card is configured as required by your computer and operates at RS-232C signal levels (refer to your computer Manual).

Set the switches on the rear panel of the Printer as follows (refer to the instructions on the rear panel for the switch locations):

1. BUSY POLARITY switch — Set this switch to the proper polarity to control the signal source, if you are using hardware handshaking.

2. DC1/DC3 switch — With this switch activated, an ASCII "DC3" (control S) is transmitted when the line buffer is within 20 characters of being full, or when the Printer is taken "off line." When there is room for 66 characters in the buffer and the Printer is "on line", ASCII DC1 (control Q) is transmitted. This signal is present at the serial output (pin 2) and may be used as a software handshake to control the signal source. ON LINE/OFF LINE also generates control Q and control S for handshaking.

3. PARITY switches — These switches must be set to the same type of parity that is used by the signal source. If no parity is selected, the parity bit is ignored.

NOTE: If Parity is on, a 7-bit data word plus one parity bit is used. If parity is off, an 8-bit data word is used. However, this Printer ignores the eighth bit in all cases.

DATA "J Bin"
COMMUNICATIONS
EQUIPMENT
(DCE)   INTERFACE CABLE   PRINTER
                                                   (DTE)

DCE	Pin		Pin	DTE
PROTECTIVE GROUND	1		1	PROTECTIVE GROUND
SERIAL (RS-232C) INPUT	2		2	SERIAL (RS-232C) OUTPUT
SERIAL (RS-232C) OUTPUT	3		3	SERIAL (RS-232C) INPUT
REQUEST TO SEND (RTS)**	4		4	REQUEST TO SEND (RTS)**
CLEAR TO SEND (CTS)	5		5	CLEAR TO SEND (CTS)*
DATA SET READY (DSR)	6		6	DATA SET READY (DSR)*
SIGNAL COMMON	7		7	SIGNAL COMMON
BUSY **	11		11	BUSY **
DATA TERMINAL READY	20		20	DATA TERMINAL READY***

NOTE: TO MEET FCC INTERFERENCE REQUIREMENTS, YOU MUST USE A SHIELDED-TYPE CABLE. THE SHIELD MUST BE BONDED TO THE CHASSIS AT BOTH ENDS.

*THESE SIGNALS ARE IGNORED BY THE PRINTER

**CHECK YOUR COMPUTER MANUAL FOR THE PIN NUMBER OF THE HARDWARE BUSY INPUT. YOU CAN SELECT THE POLARITY OF THIS SIGNAL WITH SWITCH SW202 ON THE REAR PANEL OF THE PRINTER. THIS SIGNAL IS AVAILABLE AT PINS 4 AND 11.

***THESE SIGNALS ARE "ON" WHENEVER THE PRINTER IS TURNED ON.

PICTORIAL 2-7

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4. BAUD switches — These switches must be set to the same baud rate as the signal source.

5. ETX/ACK switch — When this software handshake switch is activated and the Printer encounters an ASCII ETX during the transfer of characters from the line buffer to the print buffer, the Printer will send an ACK on the serial output line*. This allows the Printer to receive up to 255 characters before ETX is received, and maintains the proper handshaking.

*When the buffer is empty.

Note that changes in the rear panel switches will not become effective until the Printer is reset using the **rear panel** reset switch or until the unit is turned off and then back on.

Refer to Pictorial 2-8 and set the jumpers on the logic circuit board (inside the Printer) as shown.

Computer
2/3 — 4/5 — 6/20

PARITY — ∅∅
8 bit

no stop bit

RS-232
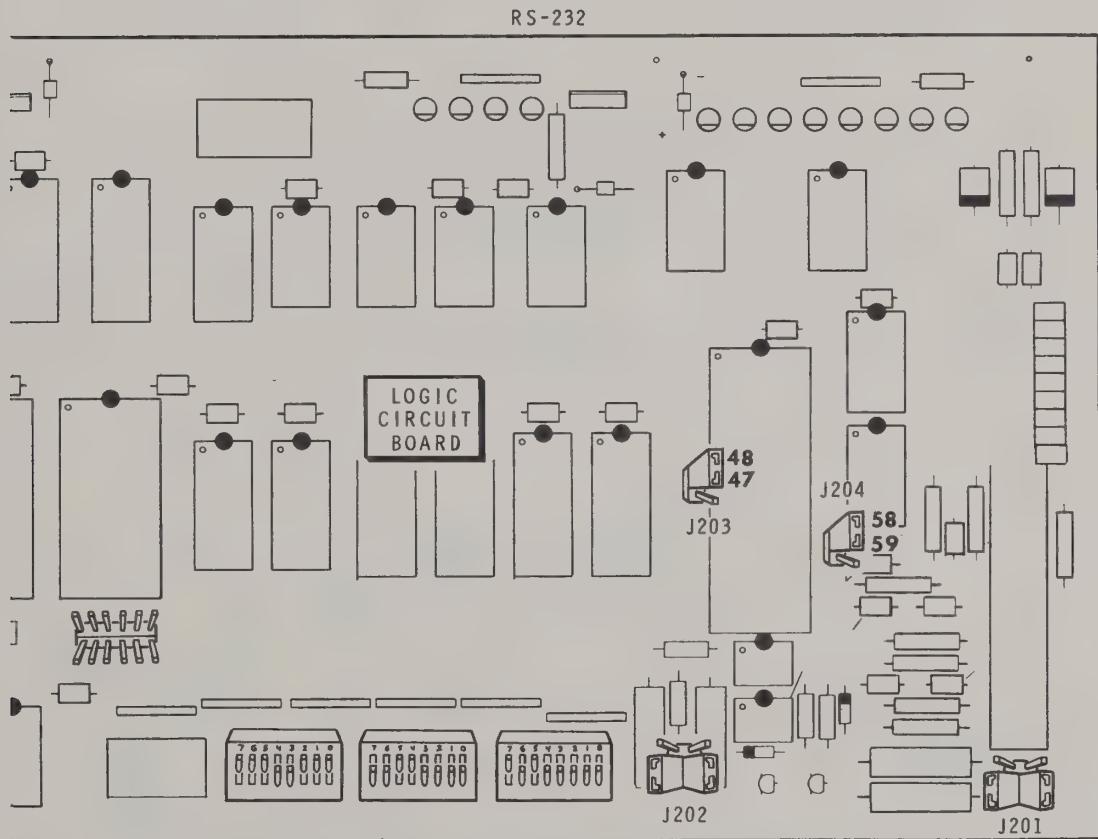
PICTORIAL 2-8

20 mA CURRENT LOOP INTERFACING

NOTE: You must use software handshaking in either the active or the passive current loop mode.

Printer Passive Current Loop

Refer to Pictorial 2-9 and, if necessary, modify your interconnect cable for the passive current loop pin output configuration shown.

Connect the interface cable between your Printer and the signal source (active).

Refer to Pictorial 2-10 and set the six jumpers on the logic circuit board (inside the Printer) as shown.
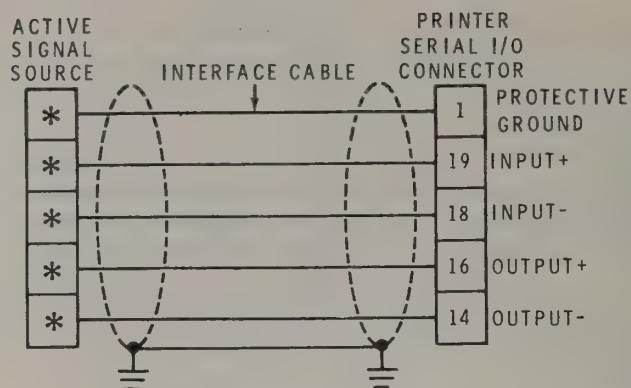
ACTIVE SIGNAL SOURCE   INTERFACE CABLE   PRINTER SERIAL I/O CONNECTOR

*
*
*
*
*

1 PROTECTIVE GROUND
19 INPUT+
18 INPUT-
16 OUTPUT+
14 OUTPUT-

NOTE: TO MEET FCC INTERFERENCE REQUIREMENTS, YOU MUST USE A SHIELDED-TYPE CABLE. THE SHIELD MUST BE BONDED TO THE CHASSIS AT BOTH ENDS.

* REFER TO YOUR SIGNAL SOURCE MANUAL FOR THE PROPER CONNECTIONS.

PICTORIAL 2-9

PRINTER PASSIVE CURRENT LOOP

LOGIC CIRCUIT BOARD

J203 47 49

J204 59 60

J202

J201

PICTORIAL 2-10

Heathkit
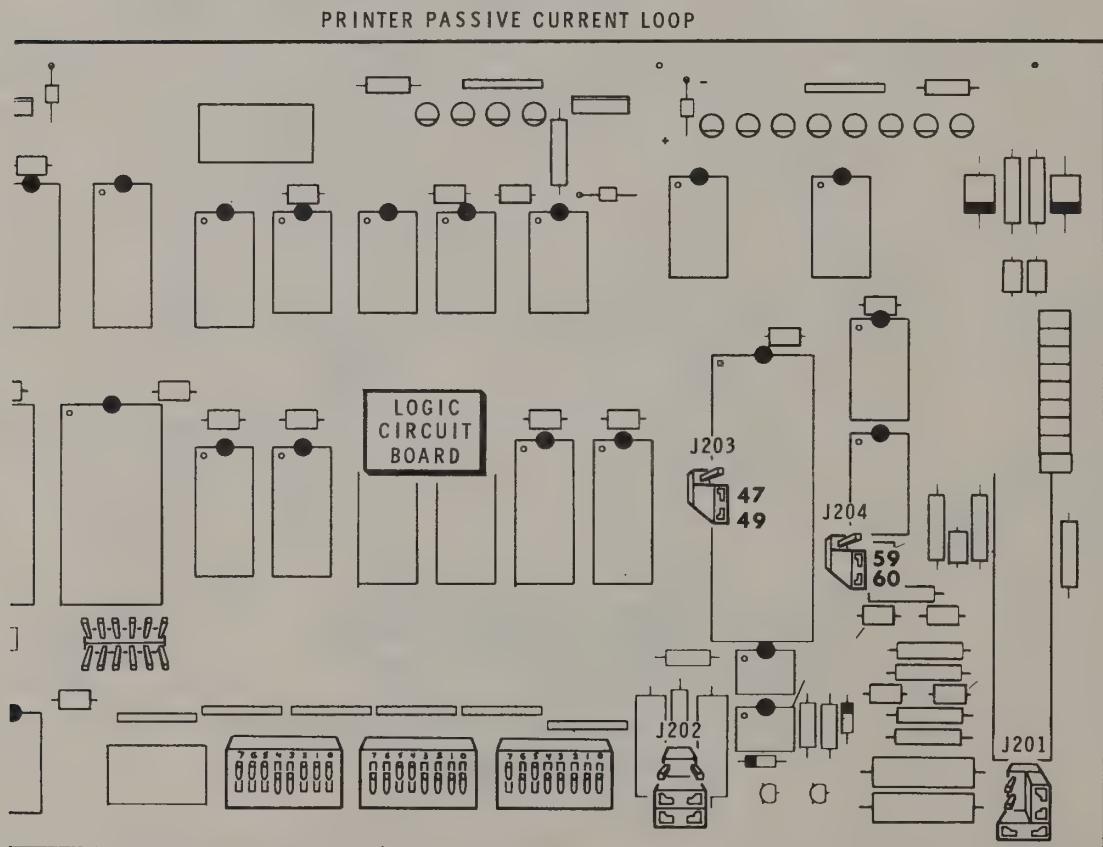
Printer Active Current Loop

Refer to Pictorial 2-11 and, if necessary, modify your interconnect cable connector as shown.

Connect the interface cable between your Printer and the signal source (passive).

Refer to Pictorial 2-12 and set the jumpers on the logic circuit board (inside the Printer) as shown.

This completes the "Non-Heath/ZDS System Configuration." Proceed to "Programming" on Page 20.
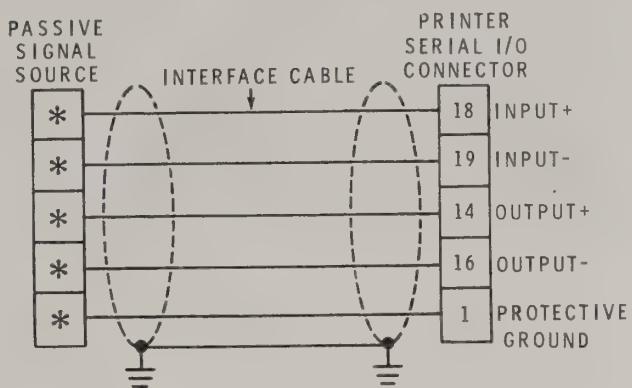
NOTE: TO MEET FCC INTERFERENCE REQUIREMENTS, YOU MUST USE A SHIELDED-TYPE CABLE. THE SHIELD MUST BE BONDED TO THE CHASSIS AT BOTH ENDS.

* REFER TO YOUR SIGNAL SOURCE MANUAL FOR THE PROPER CONNECTIONS.

PICTORIAL 2-11

PRINTER ACTIVE CURRENT LOOP
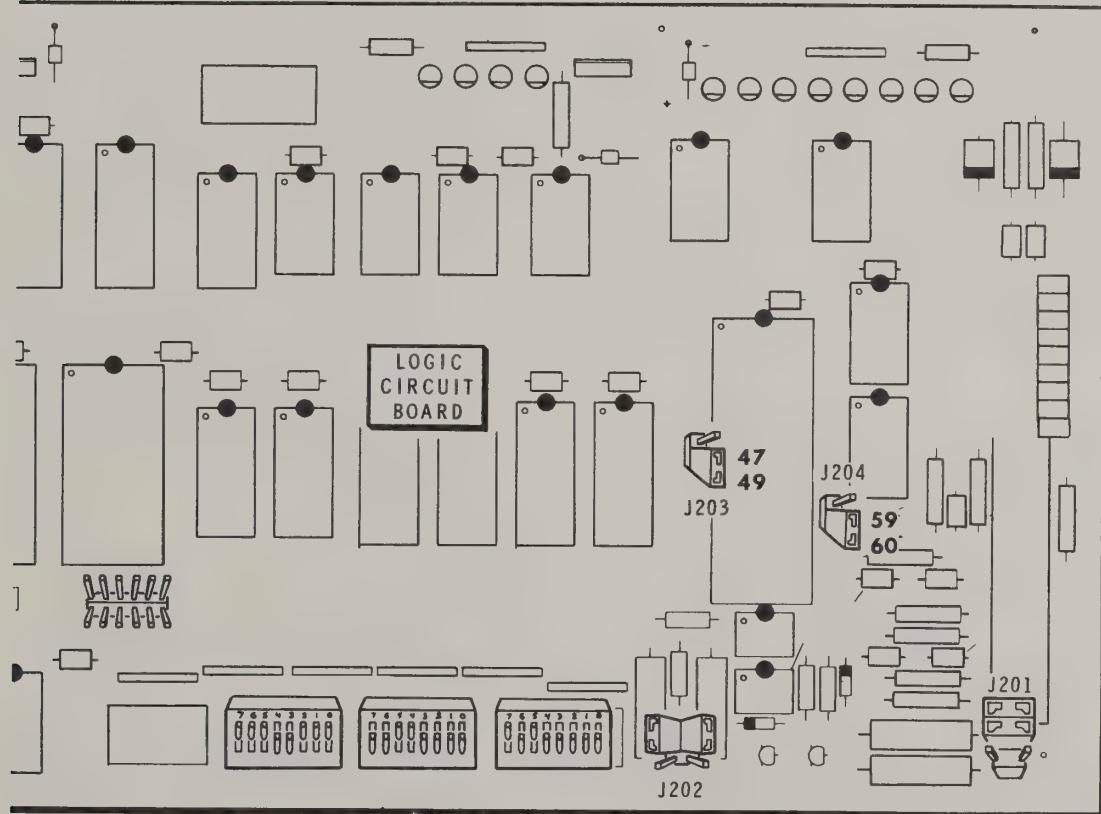
PICTORIAL 2-12
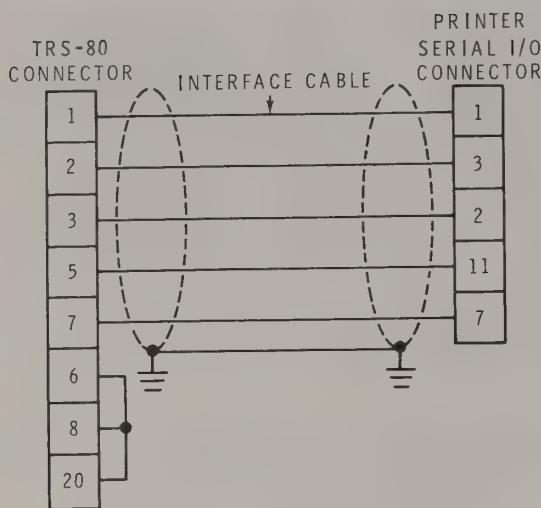
NOTE: TO MEET FCC INTERFERENCE REQUIREMENTS, YOU MUST USE A SHIELDED-TYPE CABLE. THE SHIELD MUST BE BONDED TO THE CHASSIS AT BOTH ENDS.

PICTORIAL 2-13

TRS-80 MODEL II INTERFACING

To operate the TRS-80 Model II computer with the H-25 Printer, it will be necessary to modify the male connector end (with the pins) of the RS-232 cable.

Refer to Pictorial 2-13 and modify the male pin end of your interconnect cable as shown.

Connect the female pin end of the cable to the Serial I/O connector on the rear panel of the Printer. Connect the other end of the cable to the TRS-80 computer through Serial Channel Port B (on the back panel of the video screen).
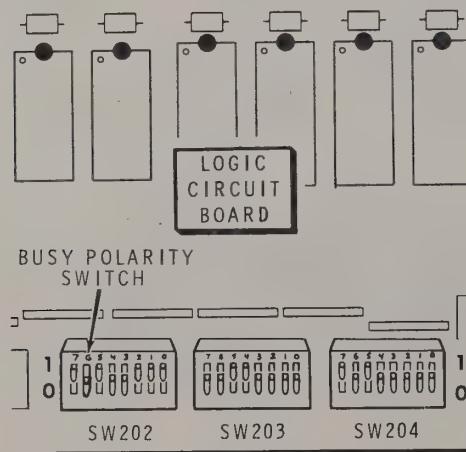
PICTORIAL 2-14

Refer to Pictorial 2-14 and set the BUSY POLARITY switch on the rear panel of the Printer to 0. This provides the proper handshaking between the computer and the Printer.

MODEL II INTERFACING WITH TRSDOS

Use the following TRSDOS (version 1.2) commands to access the Printer:

1. Turn on the power and sign on. Then run the SETCOM and FORMS as shown in the following example:

   SETCOM B = (4800,7,N,1)   ENTER

   FORMS (P=66,L=60,W=132,C=0D,S)   ENTER

The SETCOM command in the above example enables port B, set the baud rate to 4800, sets the number of data bits to 7, calls for no parity bit, and calls for one stop bit. You may set the baud rate and the parity to any other parameters that the Printer will support by setting the switches on the rear panel of the Printer accordingly.

The FORMS command in the example sets the page length to 66, calls for 60 lines of print, sets the page width to 132 characters, sets the control code to a carriage return, and selects the serial printer driver. You may change these parameters to suit you, but you must use the serial printer option.

2. After you execute the command, the computer will ask you if the Printer is ready. Place the Printer on line, type Y (for yes), and, if you wish, set the Printer to the desired top of form. If the Printer is not ready, or if there is anything wrong with the cable, the video screen will display "ERROR 45."

NOTE: Since the computer defaults to a parallel printer upon power up, you must:

1. Initialize the SETCOM and FORMS command each time you power up or reset the computer.

2. Reset all of the parameters each time you power up. If you wish to change a particular parameter during power up (width, for example), you may use the following abbreviated command:

   FORMS (W=80,,S)

After you perform the SETCOM and FORMS commands, you can use all of the utility programs that are supported by the TRSDOS. For example:

LIST TEXTFILE/1 PRT (which causes the Printer to print the contents of TEXTFILE/1).

LIST TEXTFILE/1 PRT, SLOW, R=100, A (which causes the listing to start with the 100th record in TEXTFILE/1. The Printer will pause after each record and only ASCII characters will be printed).

DIR {SYS,PRT} (which causes the Printer to print a directory of the system and user files).

MODEL II INTERFACING WITH LIFEBOAT CP/M

Use the following CP/M2 commands to access the Printer:

1. Power up and run the CONFIG program on your CP/M2 system disk as follows:

Assign the LIST device (in "I/O Assignments") to serial port B.

Set the baud rate to a value that the Printer will support.

To exit from CONFIG, use exit option 1 ("write modifications to the disk and exit to CP/M by a 'cold' boot"). NOTE: Since this information is written on the disk, you do not have to repeat it upon each power up or reset.

2. Set the switches on the rear panel to the proper baud rate, to match the procedure in the above step. Set the PARITY switches to 00 (none), and set the BUSY POLARITY switch to 0. (The Printer data length is 8 bits.)

3. Use the PIP command to cause the Printer to produce a hard copy. For example:

```
PIP LST: = MYFILE.DOC <ENTER>
(which causes the Printer to
print the contents of MYFILE.DOC)
```

Refer to your TRS-80 Model II Owner's Manual for more information concerning the operation of the computer with a Printer.

This completes the "Interface (hardware) Requirements." Proceed to "Programming."

PROGRAMMING

The setting of the switches on the rear of the Printer
determine the initial Printer format (see "Interface
Requirements"). You may also wish to change these
formats through software. This section of the Manual
provides you with the necessary information for mak-
ing these changes.

ESCAPE SEQUENCE COMMANDS

ESCAPE SEQUENCE	FUNCTION
ESC c	Set printer to the following configuration.

1. Send print head home.
2. No double-width mode.
3. No graphics mode.
4. Tab stop set to every eighth column.
5. Vertical tab stop set to every line.
6. Clear buffer.

NOTE: The following items depend upon the switch settings:

7. Discard EOL or wrap-around.
8. Horizontal pitch.
9. Vertical pitch.
10. Form length.
11. Skip fold length.
12. Set left margin at 0, right margin to maximum length.

SO	(16Q) (Control N)	Enter double width mode (exit upon line terminate).
SI	(17Q) (Control O)	Send head home.
ESC M or DC4	(24Q) (Control T)	Reverse index (line feed).
ESC [10 m		Enter graphics mode.
ESC [11 m		Exit graphics mode.
ESC [? 7 h		Discard at end of line.
ESC [? 7 ℓ 1		Wrap-around at end of line.
ESC [w		Set horizontal pitch to 10 char/inch.
ESC [0 w		Set horizontal pitch to 10 char/inch.
ESC [1 w		Set horizontal pitch to 10 char/inch.
ESC [2 w		Set horizontal pitch to 12 char/inch.
ESC [3 w		Set horizontal pitch to 13.2 char/inch.
ESC [4 w		Set horizontal pitch to 16.5 char/inch.

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ESC [x	Set vertical pitch to 6 lines/inch.
ESC [0 x	Set vertical pitch to 6 lines/inch.
ESC [1 x	Set vertical pitch to 6 lines/inch.
ESC [2 x	Set vertical pitch to 8 lines/inch.
ESC H	Set horizontal tab at active column.
ESC 1	Set horizontal tab at active column.
ESC [g	Clear horizontal tab at active column.
ESC [0 g	Clear horizontal tab at active column.
ESC [2 g	Clear all horizontal tab stops.
ESC [3 g	Clear all horizontal tab stops.
ESC [t	Set horizontal tabs to every eighth column.
ESC 2	Clear all horizontal tab stops.
ESC [Pn ; Pn ;	. . . . Pn u
	Set horizontal tab (Max 20) at the values given.
ESC [Pn ; Pn ;	. . . . Pn v
	Clear horizontal tab (Max 20) at the values given.
ESC J	Set vertical tab at active line.
ESC 3	Set vertical tab at active line.
ESC [r	Clear vertical tab at active line.
ESC [0 r	Clear vertical tab at active line.
ESC [2 r	Clear all vertical tab stops.
ESC [3 r	Clear all vertical tab stops.
ESC [4r	Set vertical tab to every line.
ESC [4	Clear all vertical tab stops.
ESC [Pn ; Pn ;	. . . . Pn p
	Set vertical tab (Max 20) at the values given.
ESC [Pn ; Pn ;	. . . . Pn q
	Clear vertical tab (Max 20) at the values given.
ESC [z	Set skip fold to no skip.
ESC [0 z	Set skip fold to no skip.
ESC [1 z	Set skip fold to skip 2 lines.
ESC [2 z	Set skip fold to skip 4 lines.
ESC [3 z	Set skip fold to skip 6 lines.
ESC [;Pn s	Set right margin.
ESC [2 K	Clear buffer.
ESC [y	Set form length to 11 inches.
ESC [0 y	Set form length to 11 inches.
ESC [1 y	Set form length to 14 inches.
ESC [2 y	Set form length to 10 inches.
ESC [3 y	Set form length to 8.5 inches.
ESC [4 y	Set form length to 8 inches.
ESC [5 y	Set form length to 7 inches.
ESC [6 y	Set form length to 6 inches.
ESC [7 y	Set form length to 5.5 inches.
ESC [8 y	Set form length to 5 inches.
ESC [9 y	Set form length to 4-1/4 inches.
ESC [10 y	Set form length to 4 inches.
ESC [11 y	Set form length to 3-2/3 inches.
ESC [12 y	Set form length to 3-1/2 inches.
ESC [13 y	Set form length to 3-1/3 inches.
ESC [14 y	Set form length to 3 inches.
ESC [15 y	Set form length to 2 inches.

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ASCII CHARACTERS

NOTE: The following ASCII characters are either ac-
cepted or transmitted by the Printer.

7-BIT OCTAL CODE	DECIMAL CODE	HEX CODE	CHARACTERS	CONTROL KEYS	DESCRIPTION
003	3	3	ETX	C	End of text.
006	6	6	ACK	F	Acknowledge; also RU.*
007	7	7	BEL	G	Rings the bell.
011	9	9	HT	I	Horizontal tab.
012	10	A	LF	J	Line feed: advances.
013	11	B	VT	K	Vertical tab (VTAB).
014	12	C	FF	L	Form feed to top of next page.
015	13	D	CR	M	Carriage return to beginning of line.
016	14	E	SO	N	Double width characters.
017	15	F	SI	O	Send head home.
021	17	11	DC1	Q	Device control 1: turns transmitter on (XON).*
023	19	13	DC3	S	Device control 3: turns transmitter off (XOFF).*
024	20	14	DC4	T	Reverse line feed.
033	27	1B	ESC	[	Escape.

*Transmitted by Printer.

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7-BIT OCTAL CODE	DECIMAL CODE	HEX CODE	CHARACTERS	DESCRIPTION
040	32	20	SP	Space.
041	33	21	!	Exclamation point.
042	34	22	"	Quotation mark.
043	35	23	#	Number sign.
044	36	24	$	Dollar sign.
045	37	25	%	Percent sign.
046	38	26	&	Ampersand.
047	39	27	'	Acute accent or apostrophe.
050	40	28	(	Open parenthesis.
051	41	29	)	Close parenthesis.
052	42	2A	*	Asterisk.
053	43	2B	+	Plus sign.
054	44	2C	,	Comma.
055	45	2D	—	Hyphen or minus sign.
056	46	2E	.	Period.
057	47	2F	/	Slash.
060	48	30	0	Number 0.
061	49	31	1	Number 1.
062	50	32	2	Number 2.
063	51	33	3	Number 3.
064	52	34	4	Number 4.
065	53	35	5	Number 5.
066	54	36	6	Number 6.
067	55	37	7	Number 7.
070	56	38	8	Number 8.
071	57	39	9	Number 9.
072	58	3A	:	Colon.
073	59	3B	;	Semicolon.
074	60	3C	<	Less than.
075	61	3D	=	Equal sign.
076	62	3E	>	Greater than.
077	63	3F	?	Question mark.

7-BIT OCTAL CODE	DECIMAL CODE	HEX CODE	CHARACTERS	DESCRIPTION	GRAPHIC SYMBOLS
100	64	40	@	At sign.	
101	65	41	A	Letter A.	
102	66	42	B	Letter B.	
103	67	43	C	Letter C.	
104	68	44	D	Letter D.	
105	69	45	E	Letter E.	
106	70	46	F	Letter F.	
107	71	47	G	Letter G.	
110	72	48	H	Letter H.	
111	73	49	I	Letter I.	
112	74	4A	J	Letter J.	
113	75	4B	K	Letter K.	
114	76	4C	L	Letter L.	
115	77	4D	M	Letter M.	
116	78	4E	N	Letter N.	
117	79	4F	O	Letter O.	
120	80	50	P	Letter P.	
121	81	51	Q	Letter Q.	
122	82	52	R	Letter R.	
123	83	53	S	Letter S.	
124	84	54	T	Letter T.	
125	85	55	U	Letter U.	
126	86	56	V	Letter V.	
127	87	57	W	Letter W.	
130	88	58	X	Letter X.	
131	89	59	Y	Letter Y.	
132	90	5A	Z	Letter Z.	
133	91	5B	[	Open brackets.	
134	92	5C	\	Reverse slash.	
135	93	5D	]	Close brackets.	
136	94	5E	↑	Up arrow/caret.	
137	95	5F	_	Underscore.	

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7-BIT OCTAL CODE	DECIMAL CODE	HEX CODE	CHARACTERS	DESCRIPTION	GRAPHIC SYMBOLS
140	96	60	`	Grave accent.	
141	97	61	a	Letter a.	
142	98	62	b	Letter b.	
143	99	63	c	Letter c.	
144	100	64	d	Letter d.	
145	101	65	e	Letter e.	
146	102	66	f	Letter f.	
147	103	67	g	Letter g.	
150	104	68	h	Letter h.	
151	105	69	i	Letter i.	
152	106	6A	j	Letter j.	
153	107	6B	k	Letter k.	
154	108	6C	l	Letter l.	
155	109	6D	m	Letter m.	
156	110	6E	n	Letter n.	
157	111	6F	o	Letter o.	
160	112	70	p	Letter p.	
161	113	71	q	Letter q.	
162	114	72	r	Letter r.	
163	115	73	s	Letter s.	
164	116	74	t	Letter t.	
165	117	75	u	Letter u.	
166	118	76	v	Letter v.	
167	119	77	w	Letter w.	
170	120	78	x	Letter x.	
171	121	79	y	Letter y.	
172	122	7A	z	Letter z.	
173	123	7B	{	Left brace.	
174	124	7C	¦	Vertical bar (broken).	
175	125	7D	}	Right brace.	
176	126	7E	~	Tilde.	

Graphic Symbols

Graphic symbols and codes printed when the graphic mode is selected.

Octal ( )
Decimal [ ]
Hex

(136) [94] 5E↑	(137) [95] 5F_	(140) [96] 60	(141) [97] 61 a	(142) [98] 62 b	(143) [99] 63 c
(144) [100] 64 d	(145) [101] 65 e	(146) [102] 66 f	(147) [103] 67 g	(150) [104] 68 h	(151) [105] 69 i
(152) [106] 6A j	(153) [107] 6B k	(154) [108] 6C l	(155) [109] 6D m	(156) [110] 6E n	(157) [111] 6F o
(160) [112] 70 p	(161) [113] 71 q	(162) [114] 72 r	(163) [115] 73 s	(164) [116] 74 t	(165) [117] 75 u
(166) [118] 76 v	(167) [119] 77 w	(170) [120] 78 x	(171) [121] 79 y	(172) [122] 7A z	(173) [123] 7B {
(174) [124] 7C ¦	(175) [125] 7D }		(176) [126] 7E ~		

PICTORIAL 2-15

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TROUBLESHOOTING

If you encounter problems in your system, investigate to see if you can locate the component causing the problems. The Printer "Test" function can be used to verify the good condition of virtually all of the Printer except for the interface connections. The chart below lists basic problems that might occur in the Printer. You can usually remedy these problems without calling an electronics serviceman.

Problems in the Printer itself are discussed in the "Service Information" section of this Manual.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
Will not print. Power light off.	Line plug not plugged in. Power Switch off. Fuse F1 blown.
Will not print. Power light on.	On/Off Line button in off-line position. On-Line light is out.
Print is not dark enough.	Print head or adjustment lever not properly adjusted (see "Operating Instructions"). Ribbon needs replacement.
Print head snags on ribbon.	Print head adjusted too close to the ribbon. Print pins damaged or pin bearings dirty.
Printed material is garbled. Parts of printed material missing.	Baud rate set incorrectly. Busy signal polarity not set properly during interfacing.
Will not print. Fault light on. Reset button doesn't correct condition.	Print unit not latched. Air vent obstructed (overheat). Fan not operating (overheat).
Ink smears on paper.	Ribbon not properly installed. Print head or ribbon shield is dirty. Print head too close to form. Ribbon guides rub against form.

See "Service Information" for troubleshooting electronic operating problems in the Printer.

SERVICE INFORMATION

This section of the Manual is designed for the advanced technician. It shows you how to completely adjust the Printer, perform periodic maintenance, troubleshoot the various circuits, and provides other information that may be useful to the technician.

ADJUSTMENTS AND MAINTENANCE

This section of the Manual shows you how to clean and adjust your Printer for optimum results. It also shows you how to replace the drive belts and the ribbon cartridge.

NOTE: All the bearings in this Printer are permanently-lubricated. Do not attempt to lubricate your Printer.

CLEANING

Refer to Pictorial 3-1 (Illustration Booklet, Page 6) for the following steps.

Use the following procedure to clean your Printer whenever it becomes necessary. If the print becomes smeared or unclear, it may be an indication that the print head needs to be cleaned. In addition, check the head and ribbon shield occasionally for the buildup of dust or ink.

1. Be sure the POWER switch on the rear panel is at OFF.

2. Position the cabinet top in its fully open position.

3. Blow or vacuum out any dust and particles of paper.

4. Release the latches on each side of the printer unit. Then open the printer unit and use a soft cloth to clean the print head, ribbon shield, and large round shafts. DO NOT USE ANY TYPE OF SOLVENT. Be sure the rubber spacers on the large round shafts are against the sides of the printer unit. Then close the printer unit and resecure the latches.

5. Return the cabinet top to its fully closed position. To close the cabinet, pull forward on the support arm to release the detent, and lower the top.

This completes the routine cleaning of your Printer.

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PRINT HEAD DRIVE BELT
TENSION ADJUSTMENT

NOTE: To perform the following adjustments, you will have to open the cabinet top. When you complete those adjustments you wish to make, close the cabinet top. To close the top, pull forward on the support arm to release the detent, and carefully lower the top.

Refer to Pictorial 3-2 and use the following procedure to adjust the print head drive belt:

1. Loosen the two lower hex head screws in the print head drive belt tension pulley so the tension pulley can move freely. NOTE: The tension pulley automatically tightens the belt to the proper tension. Retighten the two screws securely.
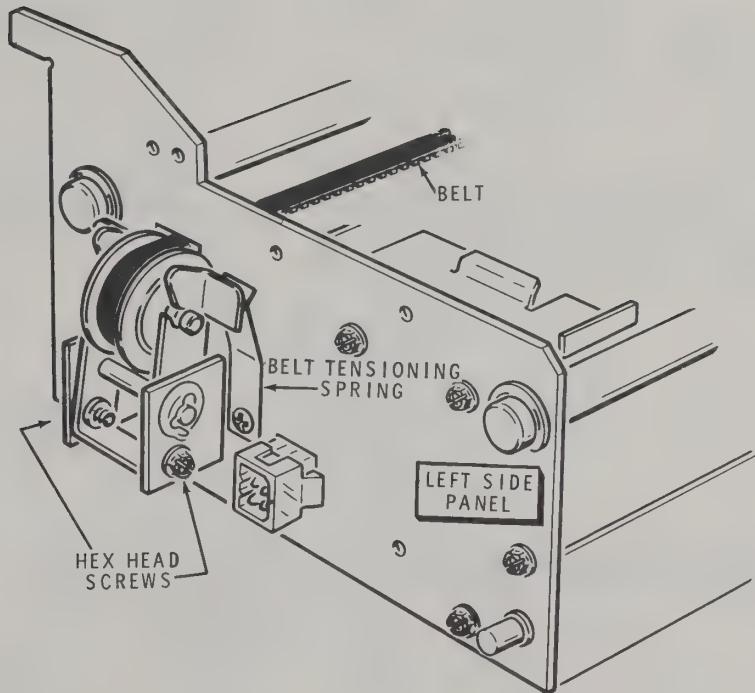
PICTORIAL 3-2

PAPER DRIVE BELT
TENSION ADJUSTMENT

Refer to Pictorial 3-3 and use the following procedure to adjust the paper drive belt:

1. Loosen the four motor-mounting screws on the right side of the Printer.

2. Slide the motor toward the rear of the Printer and push down lightly on the belt so that it deflects 1/4″ between the two large pulleys. Then tighten the four motor-mounting screws.

HEAD OVERTRAVEL
SENSOR ADJUSTMENT

Refer to Pictorial 3-4 and use the following procedure to adjust the head over-travel sensor (SW3):

1. Slide the print head to the right end of travel.

2. Make sure the top ribbon cable retainer arm closes the sensor microswitch (fully depresses the microswitch button). If it does not close the microswitch, carefully bend the retainer arm as necessary.

PICTORIAL 3-3

3. Slide the print head back and forth to make sure the sensor microswitch closes each time the head reaches its right end of travel. Listen for the microswitch to click each time.

PICTORIAL 3-4

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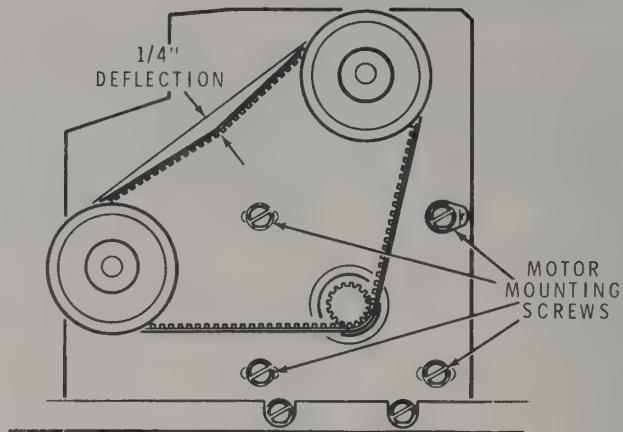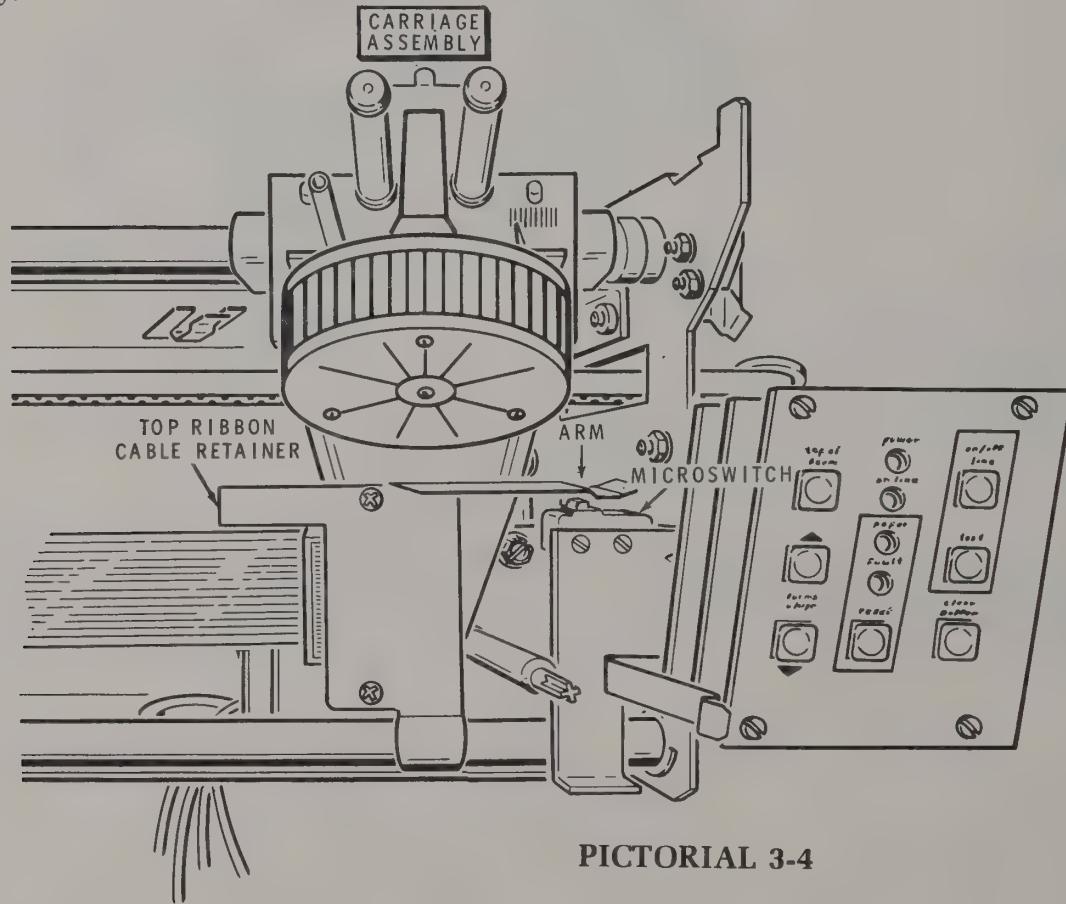
PRINT UNIT UNLATCHED SENSOR ADJUSTMENT

Refer to Pictorial 3-5 and use the following procedure to adjust the print unit unlatched sensor (SW4):

1. First check the printer unit for proper positioning. To do this, first loosen the 3/8" nut on each side of the printer unit. Then secure the latches on the printer unit and retighten the 3/8" nuts.

2. Again release the latches on each side of the printer unit.

3. Open and close the printer unit. As you close the unit, you should hear a click when the microswitch closes. If necessary, loosen the two screws on microswitch SW4 and reposition the switch so it opens and closes when you raise and lower the printer unit.

4. Resecure the latches on the printer unit.
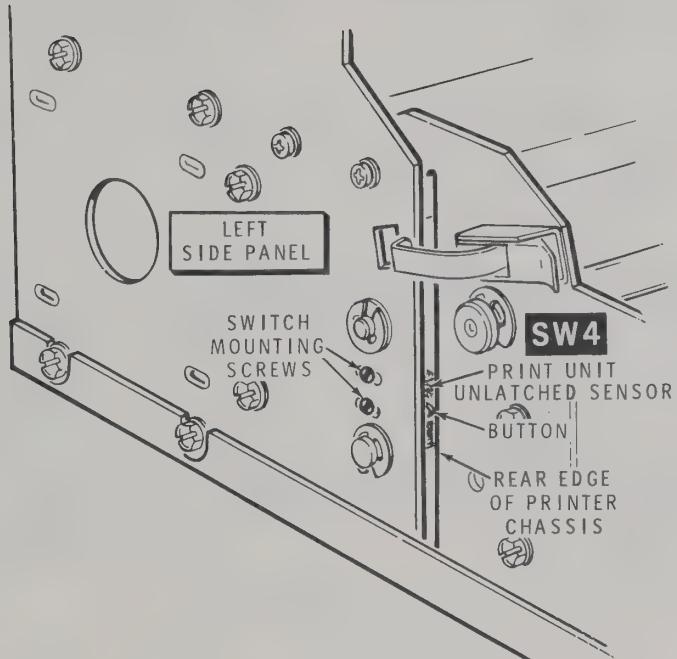
PICTORIAL 3-5

PRINT HEAD POSITION ADJUSTMENT

Refer to Pictorial 3-6 for the following procedure.

The following adjustments will allow you to position the print head for the best overall bidirectional printing of characters on single part forms.

1. Pull the Print Head Adjustment lever all the way back and observe the location of the head position pointer.

2. Move the Print Head Adjustment lever in three pointer marks.

3. Take the Printer off line and print the test pattern. To do this, press and release the ON/OFF LINE button so the ON LINE LED is out. Then press and hold the TEST button while you press and release the ON/OFF LINE button.

4. Stop the test pattern by pressing the ON/OFF LINE button.

5. Examine the printed form. Locate the upper-case "M" of the first line. There will be an upper-case "N" directly below. If the N is offset to the right of the M, the print head is slightly too close to the striker bar. Move the Head Adjustment lever forward so that the pointer moves 1/2 mark on the scale.

Repeat the test to position the print head until you find the location of the Print Head Adjustment lever that will center the N directly under the M. You should adjust the gap between the print head and the striker bar by only a fraction of one mark on the scale with the pointer for each test. If you change form thickness, you will have to adjust the print head to compensate for the change in distance between the paper and the print head.

PICTORIAL 3-6

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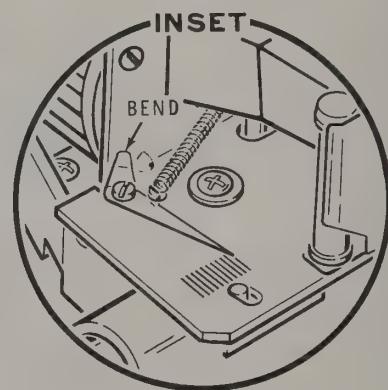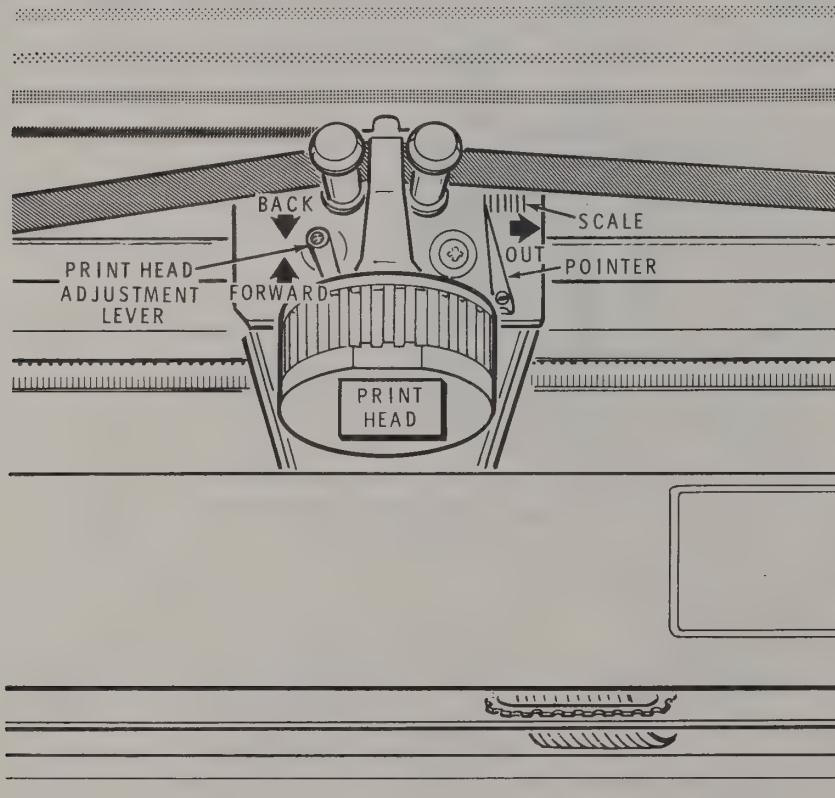
REPLACING THE PRINT HEAD DRIVE BELT

Refer to Pictorial 3-7 (Illustration Booklet, Page 7) and use the following procedure to replace the print head drive belt:

1. Release the latches on each side of the printer unit.

2. Loosen the two lower hex head screws on the print head drive belt tension pulley. Then depress the tension pulley completely and temporarily tighten the two hex head screws.

3. Remove the two screws that secure the print head to the print head mounting bracket. Then temporarily set the print head off to the left side.

4. Remove the two screws from the belt-retaining plates and remove and discard the old belt. Set the screws and the plates aside temporarily.

5. Use a belt-retaining plate and one of the screws you removed to secure one end of the new belt to the print head carriage.

6. Route the belt as shown and fasten the free end to the print head carriage with the remaining belt-retaining plate and screw. Be sure you remove any excess slack from the belt before you tighten this screw.

7. Adjust belt tension as outlined in the "Adjustments" section.

8. Reinstall the print head, close the printer unit, and resecure the two latches.

REPLACING THE PAPER DRIVE BELT

Refer to Pictorial 3-8 and use the following procedure to replace the paper drive belt:

1. Loosen the four motor-mounting screws on the right side of the Printer.

2. Slide the motor toward the front of the Printer and remove the old belt.

3. Reverse the procedure to install the new drive belt. Be sure to adjust the tension as outlined in the "Paper Drive Belt Tension Adjustment" section. Then return to this page and complete the following section.
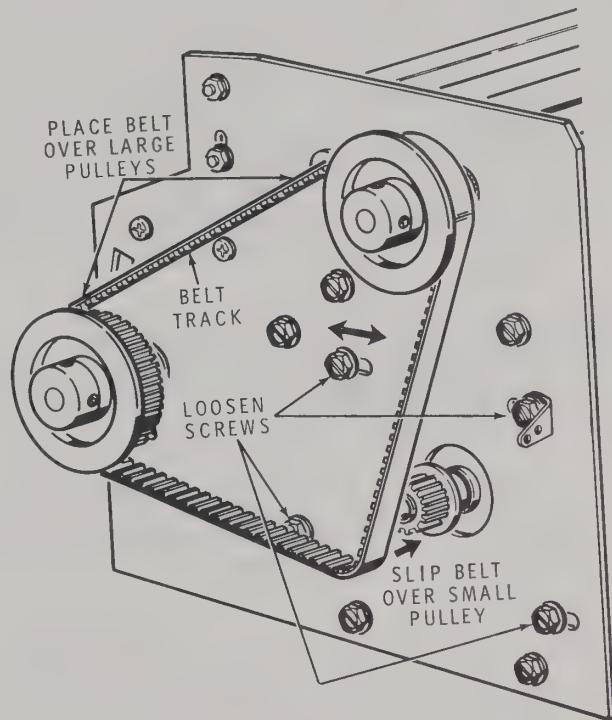
PICTORIAL 3-8

PAPER GUIDE AND TRACTOR ADJUSTMENT

Refer to Pictorial 3-9 (Illustration Booklet, Page 8) for the following procedure.

Use the following procedure to adjust the paper guides and tractors of your Printer:

1. Carefully slip the drive belt off the paper stepper drive motor sprocket and remove the belt. Do not loosen the paper stepper drive motor screws.

2. Preset the two paper guide thumbscrews so that the square rod of the paper guide is centered on the thumbscrew threads.

3. Unlatch and open the print unit.

4. Open the four tractor gates and unlock the four tractors so they are free to move.

5. Insert the form supplied with your Printer through the lower paper guide opening and thread the form onto the four tractors. Be sure that the form is parallel with the Printer and that the left and right tractor sprockets engage the corresponding holes in the form. Close the four tractor gates.

6. Position the four tractors so that the left edge of the form aligns with the second rib of the back cover. The entire rib should be visible. Lock the upper left tractor at this position.

7. Stretch the form to the right tractor so the form is flat and the right tractor pins are centered in the form holes. Lock the upper right tractor at this position.

8. Use the previous procedure to install the form into the lower left and right tractors. The form should be flat with the left and right sprocket holes centered in the tractor sprockets.

9. If the form is bowed in the center, remove the bow by turning the upper tractor drive shaft to advance the form slightly.

10. Reinstall the drive belt on the two tractor drive shafts so the belt engages the sprockets at the nearest tooth where the form is just tight. Once you have located this tooth spacing, stretch the belt onto the stepper motor drive sprocket and fully install the belt.

11. Adjust both paper guide thumbscrews counterclockwise 1/2 turn.

12. Manually rotate the drive shafts to advance the form four or five sprocket holes.

13. Pull on the exposed top of the form to remove the slack, adjust the thumbscrews for the position which centers the tractor sprockets in the form holes.

NOTE: For most applications, it will only be necessary to readjust the position of the two right tractors for a different size form. When the tractor sprockets are centered in the form holes and there is no looseness or bows in the form, the paper guides are properly set. It should not be necessary to remove the drive belt for different forms since the adjustment has been performed to the approximate center of this adjustment range.

When it is necessary to align the printing columns on a form, simply adjust the location of all four tractors to the correct location of the form on the Printer.

REPLACING THE RIBBON CARTRIDGE

Refer to Pictorial 3-10 (Illustration Booklet, Page 9) and use the following procedure to replace the ribbon cartridge:

1. Release the cartridge spring at the right side of the ribbon cartridge. Then raise the right end of the old cartridge and remove it from the Printer.

2. Release the latch on each side of the printer unit. Then open the printer unit.

3. Start the hook on the cartridge bracket into the left side of the new cartridge. Then lower the cartridge all the way into the printer unit and secure it with the cartridge spring. Be sure the ribbon is between the print head and the ribbon shield.

4. Close the printer unit and resecure the two latches.

PAPER GUIDE AND TRACTOR ADJUSTMENT

Refer to Pictorial 3-9 in the Illustration Booklet for the following steps.

1. Preadjust both thumbscrews (left and right) so that the square rod of the upper paper guide is centered along the threaded portion of the thumbscrew.

2. Unlatch the print unit and tip it open.

3. Unlock all four tractors so that they can be moved from left to right, and open the paper hold-down of all four tractors.

4. Position the lower left tractor approximately 2" from the left side panel and lock it in position.

5. Thread the form through the lower paper guide and up through the Printer far enough to completely engage the upper tractors.

6. Engage the form on the lower left tractor and close the hold-down.

7. Slide the lower right tractor into position to mate with the tractor holes on the right side of the form, and close the tractor, but do not lock it yet.

8. Advance the paper drive belt to a position that exposes the two setscrews in the upper drive sprocket, and, loosen the two setscrews just enough to allow the shaft to rotate without the sprocket.

9. Position the upper left tractor where the form holes will engage the tractor pins, and close the hold-down. Do not lock this tractor yet.

10. Repeat the above step for the upper right tractor.

11. Rotate the upper tractor drive shaft until the slack is just removed from the form, then re-tighten the sprocket setscrews securely.

12. Lock the lower right tractor at the position which removes the slack from the form but does not stretch the holes in the form.

13. Adjust the upper paper guide thumbscrews to the position that centers the tractor pins within the form holes at the upper tractor. Pull very gently on the top of the form as you do this to remove excess slack.

14. Lock the left upper tractor in the position that centers the pins on the form holes.

15. Lock the right upper tractor at the position that centers the pins in the form holes when the form is perfectly flat and smooth.

16. Close and latch the print unit.

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HEAD HOME SENSOR ADJUSTMENT

The following test will allow you to check and make sure that the home sensor switch is adjusted properly.

1. Turn the Printer on.

2. Press and release the ON/OFF LINE button on the control panel.

3. Press and hold the TEST button. Then press the ON/OFF LINE button and release both buttons simultaneously.

4. As the Printer begins to print the first line of the alphabet, press and release the ON/OFF LINE button after the Printer has completed about 1/2 of the line. The print head will continue to print to the end of the line and then stop.

Repeat steps 2, 3, and 4 approximately six times. When you have completed the six lines, check each vertical row of characters and make sure they are exactly in line with each other. If each vertical row of the characters are exactly in line with each other, the head home sensor is properly adjusted. If the characters are not exactly in line (they will waver back and forth slightly), perform step 5:

5. Refer to Pictorial 3-11 and loosen the Head Home Sensor switch mounting screws just enough to move the sensor toward or away from the print head, (in whichever direction it will move the most). Then retighten the mounting screws.

After you have adjusted the switch, go back and repeat steps 2, 3, and 4 to make sure each vertical row of characters are exactly in line. If they are not, move the Head Home Sensor in the other direction as far as possible.
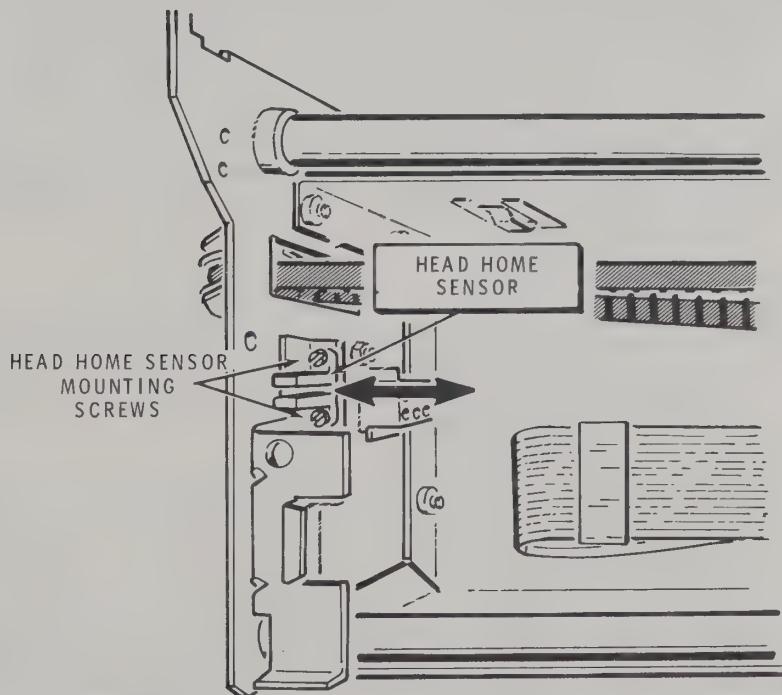
PICTORIAL 3-11

SERVICE
TROUBLESHOOTING

Use the following information only after you have decided that an electronic problem exists in the Printer. The Printer "Test" function will normally show if the problems are from within.

INDICATOR LIGHTS

These LEDs monitor signal activity at various points in the lines that deal with the printing process. The block diagram shows these points most clearly. An experienced serviceman can use the indicators to identify the circuit board, and often what area of the board, where the signal is lost. The circuit description can be helpful when you perform service using the indicator lights.

Use the following "Troubleshooting Chart" to help identify problems from their symptoms. The chart lists conditions and possible causes for several specific malfunctions. Use the chart and the indicator lights to locate which circuit board has the malfunction; circuit boards can be returned (package carefully, if mailed or shipped) for repair according to applicable terms of our warranty (inside the rear cover). Also refer to "Service Information" inside the rear cover.

If you have electronics service skill, you may wish to service some problems yourself. In the following chart, if a particular part is mentioned, check that part and other components that are associated with it. Remember to locate and correct the cause, when components are damaged, or the problem could reoccur.

Refer to the "Circuit Board X-Ray Views" for the physical location of parts on the circuit boards.

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Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
Print head moves, but does not print.	Head driver fuse F401. Head driver board, or logic board.
Printing has one (horizontal) row of dots missing.	Print pin bearings dirty. Head driver board, or logic board. Print head faulty.
Head carriage steps slowly to the right and will not seek "home."	Obstruction in optic sensor. Faulty sensor. Disconnected harness plug.
Head carriage moves erratically (misses steps).	Loose drive pulley on the head drive motor. Loose belt. Carriage binds on the guide rods. Open head drive motor. Fault on motor driver board or logic board.
Head carriage will not move at all.	Head carriage is binding on the guide rods. Broken drive belt. Fuse on motor driver board.
Head carriage moves in reverse direction.	One motor winding is reversed.*
Print lines are misaligned horizontally.	Head carriage binding. Loose belt. Loose pulley. Motor bearings are worn.
Ribbon will not move.	Faulty ribbon motor. Fault on motor driver board. Fault on logic board. Faulty capacitor C525 or C509. Jammed ribbon cartridge.
Will not feed paper.	Faulty paper drive motor. Fault on motor drive board. Fault on logic board. Loose pulley. Paper feed mechanism. Broken or loose belt.
Feeds paper erratically.	Low motor winding current. Loose pulleys. U236 or U237.
Feeds paper backwards.	**Reversed motor windings.
Paper feeds for a few seconds when Printer is first turned on. Print head does not move to the left.	Stepper motor sockets interchanged at P505 and P506 on motor driver circuit board.

* Remove socket S505 from plug P505 on the motor driver circuit board and
  interchange pins 1 and 2 **or** pins 4 and 5.

** Remove socket S506 from plug P506 on the motor driver circuit board and
interchange pins 1 and 2 **or** pins 4 and 5.

THEORY OF OPERATION

Refer to the Block Diagram (Illustration Booklet, Page 12) while you read this "Theory of Operation." The Z-25AA High Speed Printer, like the computer, is a microprocessor-controlled device. The cable between the two devices carries both the computer's instructions to the Printer and information about the Printer's status back to the computer. This information may be a series of voltage pulses (called RS-232C operation, and defined as shown in Pictorial 2-9, Page 20) or a series of current pulses (called current loop operation, with currents of about 20 mA).

The first components encountered in the Printer allow it to accept either the RS-232C or current loop type input.

The main component in the Printer is the microprocessor, which receives and interprets the instructions from the computer, controls the print head and the paper advance motor, tells the computer when to send more information, and controls the flow of information inside the Printer.

This flow of information takes place along the data bus lines. The source and destination of the information are controlled by the microprocessor, using the address bus lines.

The instructions for the microprocessor can come from both the computer and the programming in the Printer's memory. Basic operation instructions for the microprocessor are permanently installed in the ROM (read only memory), while special instructions (such as line, page length, and tab stops) can be programmed into RAM (random access memory) by the computer. RAM memory is also used to store the characters to be printed until there are enough to make one full line; then the microprocessor causes that line to be printed.

The input buffers also provide directions for the microprocessor. Their information comes from the format and communication protocol switches on the logic board, and from sensors that monitor the print head, paper, and print unit latch.

Other components in the Printer are directed by the microprocessor to switch the internal voltages and currents for rapid and precise control of the print head solenoids, carriage drive motor, paper advance motor, and ribbon advance motor.

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CIRCUIT DESCRIPTION

This Circuit Description serves two purposes. If you are a trained serviceman, it will help you to quickly understand any unfamiliar circuitry; if you are not a serviceman, it will NOT help you to service your Printer, but it will help you to gain a basic understanding of how the basic component blocks work together.

Refer to the Block Diagram and to the Schematic Diagram while reading the Circuit Description. This description deals with groups of components by addressing each group as a functional block. Each block is discussed in terms of the input it receives, the operation it performs, and the output it produces. While each block drawing shows only the main component(s) in that block, the other components that are associated with the main components should also be considered as part of that block.

INPUT BLOCKS

Interface Socket S201

This 25-pin socket connects the Printer with the data source (computer, modem, or whatever is used with the Printer). Refer to "Interface (Hardware) Requirements" on Page 10 for information about what signal each pin carries.

Serial Data Translator U201 — U204

U201 receives RS-232C level signals (see "Theory of Operation" on Page 38) from socket S202 and translates the voltage levels to TTL logic levels for use by the asynchronous communication element, U208. U204 translates the TTL level outputs from U208 to RS-232C levels for use by the data source.

Similarly, U202 receives current loop input signals and translates them to provide TTL (input) levels for U208. U203 changes the TTL output from U208 to current loop for the data source. Jumpers J201 and J202 are set to provide a current source from the Printer, if the data source does not provide one.

Asynchronous Communication Element U208

U208 receives serial data from the data source through the data translator at pin 10 ("SIN") and changes it to 8-bit parallel output at pins 1 through 8 (onto the data bus) for the microprocessor.

Internal dividers in U208 use the master clock input to generate the proper baud rate. Pin 11 provides the software handshake signal, and pin 34 provides the hardware handshake; pins 32 and 33 are always set high whenever the Printer is on.

DATA HANDLING/PROCESSING

Microprocessor U212

The microprocessor receives printing instructions from the data source, through the asynchronous communication element. It also receives program (operating) instructions from main program memory U231, and character information instructions from character font memory U234. All of this information travels on the data bus.

U212 stores the characters in the line buffer and scratch pad memory U236 & U237, until there are enough for one line of printing. U212 then recalls the characters and sends them to the data bus buffer and the output buffer to be printed. The U212 output controls the motors for the print head, paper, and ribbon, and the print head pin solenoids; and it responds to an interrupt from timer U219 when it has time to receive another character.

M1 State Delay U209

Microprocessor U212 operates at very high speeds most of the time, but the memory circuitry cannot supply information fast enough to keep up with U212. So when U212 is communicating with memory, U209 provides a "wait" signal for one clock cycle to allow the memory enough time to respond.

Chip Select Decoder U213

The input to U213 is an address from U212, which indicates which component on the data bus the microprocessor wishes to enable. The chip select then sends an enable signal to that specific component.

Address Bus

The address bus is a series of parallel paths between the memory and processing elements of the Printer control circuitry. The signals on the address bus indicate the "address" within the enabled component where the data is to be stored or retrieved. The enabled component "opens up" the selected address to send or receive data (as directed on the microprocessor "write line").

Data Bus

The data bus is similar to the address bus, except that it carries data, rather than addresses, to and from the selected components. The components are tri-state devices, and present a high impedance when not selected.

Data Bus Buffer U224

The instructions to the printing mechanisms are output on the data bus to three different data latches at one time. U224 receives the data from the microprocessor, and provides the needed drive to the inputs of all three latches.

TIMING

Master Clock U207B & C

Rapid handling of data requires that all component actions be very well coordinated with each other. The master clock is a crystal-controlled oscillator that provides the basic timing signal to which all the components respond.

Divide-By-Two's U206A & B

U206B divides the master clock output by two and produces a symmetrical clock signal so the components will have the best time signal to work from. U206A divides this signal again, to provide a lower frequency for the asynchronous communication element.

Clock Buffer U207A, Q203

The clock buffer is needed to provide higher logic levels, which are required by the microprocessor and the timer.

Divide-By-Thirty Gated Prescaler U214, U215, U218

U214 produces a divide-by-three, and U218 then divides that by ten. The resultant signal is used by timer U219 to control the printing mechanisms. U215B resets U214/U215 at the beginning of each ÷30 cycle.

Timer U219

The paper and head motors and the print head solenoids require pulses of energy at specific time intervals in order to move and print properly. The control circuitry components also require specific amounts of time to complete various tasks. U219 has three counters that are set by the microprocessor, and count in response to the clock (high level signal from buffer Q203) and divide-by-thirty inputs. They produce the intervals that time the printing (and control) operations of the Printer.

MEMORY

Main Program Memory U231, U233

U231 is a Read Only Memory (ROM) that contains the directions that tell the microprocessor what to do so the High Speed Printer will work. The address of the needed information is received on the address bus, the enable signal is received from chip select U213, and the data at that address is sent to the microprocessor on the data bus.

The operating ROM routine contained in U231 and U233 monitors how often print wires are being fired. When graphics printing becomes dense enough to be in danger of overheating the print head, a short pause will be generated at the end of each line, allowing the print head to cool slightly.

Character Font Memory U234

U234 contains the information that tells the microprocessor which pins to fire to form each character that is to be printed.

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Line Buffer and Scratch Pad Memory U236 & U237

U236 and U237 provide a special place for the microprocessor to store characters from the data source until there are enough to print a line. Other information, such as character width, vertical tabs, and horizontal tabs are also stored here.

HARDWARE CONTROL

Input Buffers U238 through U242

The input buffers receive information from the format and communication protocol switches; the head, paper, and unlatched sensors; and the front panel controls. Each buffer supplies its information to the data bus when enabled by chip select U213. The rest of the time the input buffers present a high impedance to the data bus.

Format and Communication Protocol Switches SW202, SW203, SW204

These switches allow the user to set certain operation variables and print variables. The switch outputs go to the input buffers. Some of these switch-selected variables can be altered during operation by the software.

Head, Paper, and Unlatch Sensors U1, Q1, D1, SW3, SW4

These sensors detect when the print head is at the end positions, if the paper is moving, and whether the print unit is latched in place. Their output goes to the input buffers.

Front Panel Controls and Indicators SW101 — SW107, D101 — D104

Seven normal operations controls are on the control panel, along with four status indicating LEDs. The switch outputs go to the input buffers. The indicators are through octal buffers from status latch U228, and indicate the Printer's operating status to the operator.

HEAD MOTOR DRIVE BLOCKS

Head Motor Drive Logic U205A & B, U226A & B

This logic provides the two-phase voltage patterns that the phase drivers use to drive the motor. U226A & B receive an input from timer U219 which determines how fast the motor will run, and U205A & B receive an input from control and status latch U228 which determines the voltage phase sequence (which way the motor will run).

Status Indicators D206 — D209

These indicators are directly at the output of the motor drive logic and indicate the presence of signal activity at that point.

Current Regulator U603-1A & F, U605-1A & B, 607-1A & E, Q628

The drive motor must start and reach operating speed quickly for consistent character width and overall high speed operation, and high motor-drive voltage (65 volts) is used to get this quick response. However, the current is restricted (by switching the voltage on and off) to protect the motor. Refer to "Head Motor Phase Drivers", below, for a discussion of the circuit operation.

Head Motor Phase Drivers Q611 — Q618 and Q619 — Q627

The phase drivers are turned on by the inputs from the head motor drive logic, and supply drive voltage to the motor.

The current regulator and phase drivers work together in the following way. Since the basic circuit is repeated for different voltage phases, only one complete section will be discussed.

For this discussion, assume that phase one input (to U603C) is high and phase two input (to U603D) is low. This tends to turn Q613 and Q616 on, and turn Q614 and Q615 off.

The +65-volt supply then creates a current through Q613, into the motor, back through Q616, through R622 to ground. The voltage developed across R622 is applied to comparator U606C, and compared to the reference voltage from divider R629, R631, and R655.

When the R622 current is large enough, comparator U605D changes state, turning Q613 off (through U603A, U604A, Q612, and Q611). When the current decays enough, the comparator changes state again, reapplying the +65 volts through Q613.

When the head motor drive logic changes state, Q614 and Q615 are on instead of Q613 and Q616. The control and status latch can stop the motor by turning the current off; a high on the standby line allows Q628 to turn on, shunting the voltage divider and keeping the comparator output low.

Status Indicators D623, D624, D629, D631

These indicators are directly at the output of the phase drivers and indicate drive voltages to the head drive motor.

Head Drive Motor M2

This motor controls the horizontal movement of the print head in response to the two-phase, approximately 1 ampere drive signal from the phase drivers. The motor is a 1.8 degree, four-phase, bipolar drive stepper motor.

PAPER MOTOR DRIVE BLOCKS

Paper Motor Drive Latch U223D, U227

Latch U227 provides the four-phase signal that the phase drivers use for the paper motor. These signal voltages are set (high or low) by the microprocessor on data bus lines D4 through D7, and are accepted by the latch when the signal is received from chip select decoder U213 at U223D.

Status Indicators D211-D214

These indicators are directly at the output of the latch and indicate the presence of signal activity at that point.

Current Regulator U703-A & F, U705-A & B, U707-A & E, Q728

This regulator circuit is identical to the current regulator circuit for the head drive motor, which was discussed above, and operates the same way.

Paper Motor Phase Drivers Q711 — Q718 and Q719 — Q727

These phase drivers are identical to the head motor phase drivers, discussed above, and operate the same way.

Status Indicators D723, D724, D729, D731

These indicators are directly at the output of the phase drivers, and indicate drive voltages going to the paper motor.

Paper Stepping Motor M1

This motor is a 7.5 degree, four-phase, bipolar drive stepper motor. It is used to position the paper vertically as required.

MOTOR CONTROL AND STATUS LATCH

Control and Status Latch U223C, U228

U228 receives information from the microprocessor on the data bus. The input to U223C from the chip select decoder enables U228. U228 then latches the state of the inputs for use in controlling various Printer functions. The Printer functions that are controlled are the motors, bell, and control panel indicators.

Status Indicators D501 — D513

These indicators are directly at the output of the latch and indicate the logic signal to the print head motor standby, paper drive motor standby, ribbon motor drive, and bell circuits. Other indicators driven by the control and status latch are on the control panel for the "on line," "paper," and "fault" signals.

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Ribbon Motor Driver Q501, D513

Q501 responds to a high logic level from status latch U228 by turning on and allowing C509 to charge up. This will turn triac D513 on, causing ribbon motor M3 to run.

Status Indicator D518

This indicator is directly across two lines to the ribbon motor, and indicates when a voltage exists across these lines.

Ribbon Motor M3

This two-phase synchronous motor responds to the voltage from the ribbon motor driver circuit. Capacitor C525 provides the phase difference the motor requires for two-phase operation.

Bell U501, U502

U501 is a monostable multivibrator which responds to a logic high from U228. The high may come from the data source (ASCII "bell" code) or from the Printer's microprocessor (as an audio signal accompanying the "fault" indicator). U501 then turns Q503 on for about one-half second. This allows timer U502 to run as an oscillator. Its output goes to the speaker.

Speaker A1

The speaker responds to the output of U502 with an audible tone.

PRINT HEAD CONTROL BLOCKS

Head Firing Latch U221A, B & C; U222B & E

U222E receives a positive pulse when the ninth pin of the print head is fired. This information is used to start clock 2 of timer U219, through U221A; when the clock times out, its TO2 output resets both the firing latch (through U222B) and the print head data latches (U215A and U229) through NOR gate U223A.

Print Head Data Latches U215A; U216A,B,D; U217A,D; U222F; U223A; U229

U216 and U217 direct U229 (first) and U215A (immediately after) toccept the character data from the data bus. This data is sent to the pin drivers until TO2 of the timer causes the latches to be reset (through U223A) until the next data is received.

Status Indicators D219-D228

These indicators are directly on the output of the print head data latches, and indicate signal activity at that point.

Pin Drivers #1 through #9 (Parts of) U402 — U404, Q402 — Q421

Each pin driver consists mainly of part of an IC plus two transistors. Since all are alike, only one driver will be discussed.

U402A inverts the high (print) signal from the latch, and turns on Q402. This turns on Q403, providing a ground for the pin solenoid and firing the print pin. However, the Q426 circuit (through D402) allows the IR drop across R411 to raise the base voltage of Q402, thus limiting the current through Q402 and the solenoid.

The circuit will keep the solenoid on, until one of two things happens. Normally, the signal from the latch will be removed; if this does not happen quickly enough, the +14 volts to the emitter of Q402 will be removed (see "Head Protect Circuit", which follows).

Head Protect Circuit U402 — U405, Q423 — Q425

The print head solenoids are normally turned on for about 260 μsec. If they are left on for too long, they will be damaged.

When a solenoid is fired, the head protect circuit is energized through an IC (such as U402F, for pin #1). This turns Q423 off, and allows C405 to begin charging. After 340 μsec, U405A changes state turning Q424 and Q425 off, and the +14-volt supply to the pin drivers is removed.

As an added protection, U405C detects the loss of +9-volt supply (and therefore +5 volts) which would cause all pin drivers to fire. In the event of such a loss, U405C turns Q424 and Q425 off, keeping all pin drivers off as well.

Status Indicators D416 — D425

These status indicators are directly at the output of the pin drivers and indicate the presence of a voltage across the solenoid.

Voltage Suppression Q401, Q422, D401, D434

When the solenoids are turned off, they create a large inductive voltage spike. The zener diode-transistor combination (D401/Q401 and D434/Q422) allow this energy to be quickly removed. Diodes D412 through D415 and D426 through D431 are blocking diodes to isolate the solenoids.

Print Head Solenoids #1 Through #9

In their off state, the solenoids have +65 volts at each end of the coil; when the are turned on by a pin driver, one end of the coil is grounded and the coil is energized.

MISCELLANEOUS

Power Up Reset U222C, D; SW201

This circuitry produces the signals which set or reset, all of the latches, the microprocessor, the timer, and the asynchronous communication element to the "clear" or "begin" state. This signal is generated by grounding the input to U222C in either of two ways.

At power up, C228 provides the ground before it charges; at other times, pushing SW201 (on the back of the Printer) does the same thing.

Power Supply T1; U406; BR1; D204; D205; D501 — D508

T1 transforms the line voltage to produce the AC voltages used in the various supplies.
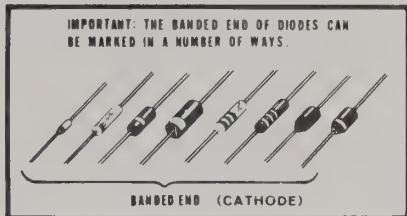
Bridge rectifier BR1, along with R1 and C5, produces the +65-volt supply on the chassis.

D501 through D504 and C501 rectify and filter the +9 volt supply on the motor driver board. Regulators U406 (on the head driver board) and U248, U249, U251 (on the logic board) use the +9 volt supply to produce regulated +5-volt supplies.
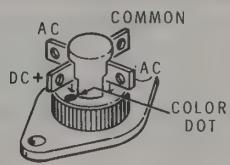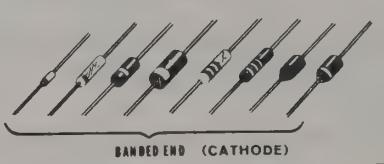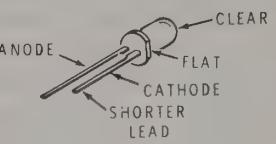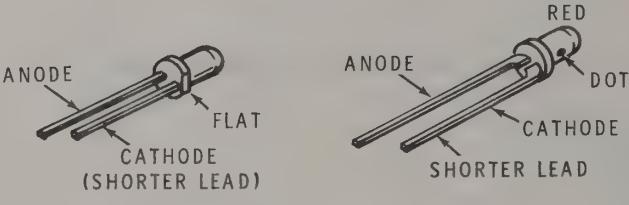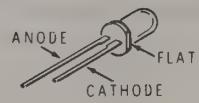
D505 through 508 (on the motor driver board) rectify for the ±15-volt supplies. The same supplies are used on the logic board, with zener diodes D204 and D205, to produce ±12-volt supplies.

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SEMICONDUCTOR IDENTIFICATION CHARTS
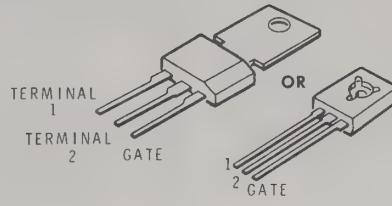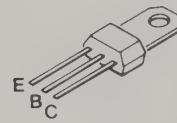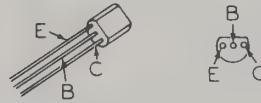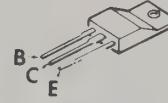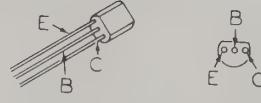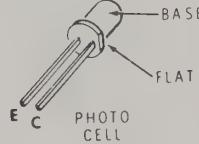
DIODES

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D432	56-6	VR6.8 OR 1N710	
D201, D202, D203, D509, D511, D514, D515, D634, D734, D635, D735	56-56	1N4149	
D401, D434	56-72	1N4755A	
D204, D205	56-90	1N4742	IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.
D433	56-612	1N5229B	
D501, D502 D503, D504	57-42	3A1	BANDED END (CATHODE)
D505, D506, D507, D508, D512, D621, D721, D626, D726, D627, D727, D633, D733, D402, D403, D404, D405, D406, D407, D408, D409, D411, D412, D413, D414, D415, D426, D427, D428, D429, D431	57-65	1N4002	
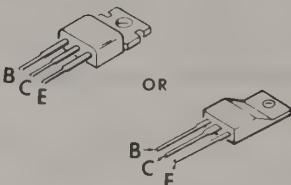
Diodes (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
BR1	57-67	10A20	
D622, D722, D728, D625, D725, D628, D632, D732	57-619	S1A1F	
D1	412-635	TIL-32	
D101, D102, D103, D104	412-633		
D206, D207, D208, D209, D211, D212, D213, D214, D215, D216, D217, D218, D219, D221, D222, D223, D224, D225, D226, D227, D228, D723, D518, D623, D629, D624, D724, D731, D729, D631, D418, D416, D417, D422, D419, D421, D425, D423, D424	412-616		

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TRANSISTORS

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D513	57-620	T106A1SG	
Q425	417-224	MPSU05	
Q612, Q712, Q618, Q718, Q621, Q721, Q627, Q727	417-294	MPSA42	
Q426	417-857	MJE5976	
Q501, Q503, Q628, Q728, Q423, Q424	417-864	MPSA05	
Q201, Q402, Q404, Q406, Q408, Q411, Q413, Q415, Q417, Q419	417-865	MPSA55	
Q203	417-874	2N3906	
Q202	417-897	SELECTED FET	
Q1	417-919	TIL-78	

Transistors (cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q611, Q711, Q617, Q717, Q619, Q719, Q626, Q726	417-927	MPSA93	
Q614, Q714, Q616, Q716, Q623, Q723, Q625, Q725, Q403, Q405, Q407, Q409, Q412, Q414, Q416, Q418, Q421	417-953	TIP150	
Q613, Q713, Q615, Q715, Q622, Q722, Q624, Q724	417-954	TIP107	
Q401, Q422	417-955	TIP102	

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INTEGRATED CIRCUITS

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U1	150-74	OPB-8135	Optical isolator	
U502	442-53	555	Timer	
U248, U249, U251, U406	442-54	7805	5-volt regulator	
U605, U705, U405	442-616	2901 or 3302	Quad comparator	
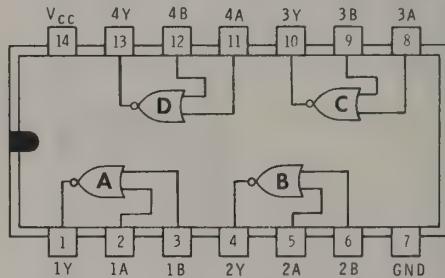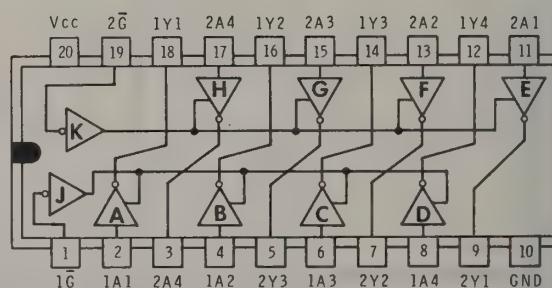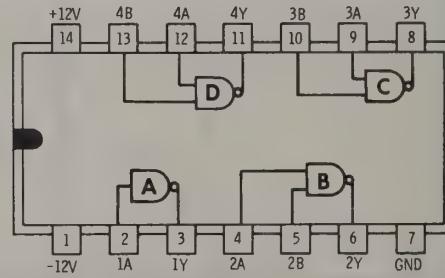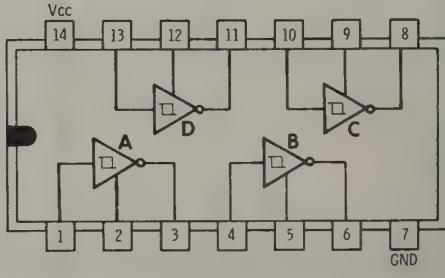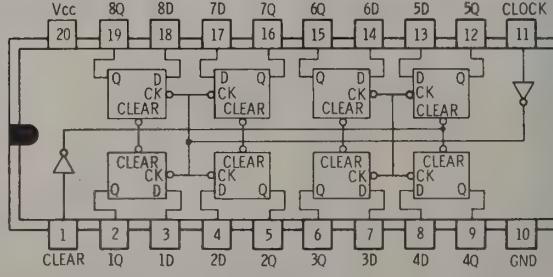
Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U501	443-23	74122	Triggerable monostable multivibrator	
U603, U703, U607, U707	443-72	7417	Line driver	
U604, U704, U606, U706	443-73	7416	Line driver	
U213	443-623	74154	4-to-16 line decoder	
U244, U245, U246, U247	443-642	7405	Hex inverter (open collector)	

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Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U217, U221	443-728	74LS00	Quad 2-input NAND gate	
U101, U206, U209, U215, U226	443-730	74LS74	Dual D-type flip-flop	
U227	443-752	74LS175	Quad latch	
U207	443-755	74LS04	Hex buffer	
U236, U237	443-764	2114	1K × 4 static RAM	

Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U216, U223	443-779	74LS02	Quad 2-input NOR gate	
U224, U238, U239, U241, U242	443-791	74LS244	Tri-state non-inverting octal buffer	
U204	443-794	75188	EIA driver	
U201	443-795	75189	EIA receiver	
U228, U229	443-803 ~~443-805~~	74LS273	8-bit latch	

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Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U202, U203	443-808	4N26	Optically-coupled Isolator	
U218	443-813	74LS90	Decade counter	
U214	443-828	74LS73	Dual J-K flip-flop	
U102	443-858	7414	Hex Schmitt-trigger inverters	
U222	443-872	74LS14	Hex Schmitt-trigger inverters	

Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U208	443-874	8250	ACE	
U211, U232	443-875	74LS32	Quad 2-input OR gate	
U205	443-891	74LS86	Quad exclusive-OR gate	
U212	443-953	3880-4	Z80A Microprocessor	

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Integrated Circuits (Cont'd.)

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
U219	443-954	3882-4	Counter-timer	
U402, U403, U404	443-967	7406	Hex line driver	
U231	444-63	444-63 (Available only from Heath Co.)	2332 Custom ROM	
U233	444-86	444-86 (Available only from Heath Co.)	2716 Operating ROM	
U234	444-64	444-64 (Available only from Heath Co.)	2716 Custom character ROM	

REPLACEMENT PARTS LIST

Control Circuit Board

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
RESISTORS		

NOTE: All resistors are 1/4-watt, 5%.

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
R101	6-151-12	150 Ω
R102	6-470-12	47 Ω
R103	6-102-12	1000 Ω
R104	6-151-12	150 Ω
R105	6-151-12	150 Ω
R106	6-151-12	150 Ω

CAPACITORS

C101	21-769	.01 μF ceramic
C102	25-863	4.7 μF electrolytic
C103	21-763	330 pF ceramic

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
LED — INTEGRATED CIRCUITS		

See "Semiconductor Identification Charts."

MISCELLANEOUS

SW101	64-883	Pushbutton switch
SW102	64-883	Pushbutton switch
SW103	64-883	Pushbutton switch
SW104	64-883	Pushbutton switch
SW105	64-883	Pushbutton switch
SW106	64-883	Pushbutton switch
SW107	64-883	Pushbutton switch

Motor Drive Circuit Board (Assembled #181-3265)

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
RESISTORS		

NOTE: All resistors are 1/4-watt, 5% unless marked otherwise.

R501	6-102-12	1000 Ω
R502	6-102-12	1000 Ω
R503	6-270-12	27 Ω
R504	6-102-12	1000 Ω
R505	6-561	560 Ω, 1/2-watt
R506	6-272	2700 Ω, 1/2-watt
R507	6-273-12	27 kΩ
R508	6-472-12	4700 Ω
R509	6-752-12	7500 Ω

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
Resistors (cont'd.)		
R510	NOT USED	
R511	6-332-12	3300 Ω
R512	NOT USED	
R513	NOT USED	
R514	NOT USED	
R615/715	6-103-12	10 kΩ
R616/716	6-273-12	27 kΩ
R617/717	6-472-2	4700 Ω, 2-watt
R618/718 ✱	6-471-12	470 Ω
R619/719	6-681-1	680 Ω, 1-watt
R620/720	NOT USED	
R621/721	6-682-1	6800 Ω, 1-watt
R622/722	3-1-3	.4997 Ω, 3-watt, 1%
R623/723	6-222-12	2200 Ω

✱ 6-682-1   6800 Ω   1 WATT

Heathkit

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
Resistors (cont'd.)		
R624/724	6-103-12	10 kΩ
R625/725	6-273-12	27 kΩ
R626/726	6-472-2	4700 Ω, 2-watt
R627/727	6-471-12	470 Ω
R628/728	6-681-1	680 Ω, 1-watt
R629	6-3010-12	301 Ω, 1%
R729	6-1780-12	178 Ω, 1%
R630/730	NOT USED	
R631/731	6-4990-12	499 Ω, 1%
R632/732	6-681-1	680 Ω, 1-watt
R633/733	6-472-2	4700 Ω, 2-watt
R634/734	6-103-12	10 kΩ
R635/735	6-273-12	27 kΩ
R636/736	6-471-12	470 Ω
R637/737	6-682-1	6800 Ω, 1-watt
R638/738	3-1-3	.4997 Ω, 3-watt, 1%
R639/739	6-222-12	2200 Ω
R640/740	NOT USED	
R641/741	6-471-12	470 Ω
R642/742	6-103-12	10 kΩ
R643/743	6-273-12	27 kΩ
R644/744	6-472-2	4700 Ω, 2-watt
R645/745	6-681-1	680 Ω, 1-watt
R646/746	6-102-12	1000 Ω
R647/747	6-102-12	1000 Ω
R648/748	6-105-12	1 MΩ
R649/749	6-222-12	2200 Ω
R650/750	6-181-12	Jumper 180 Ω
R651/751	6-222-12	2200 Ω
R652/752	6-102-12	1000 Ω
R653/753	6-102-12	1000 Ω
R654/754	6-270-12	27 Ω
R655/755	6-1000-12	100 Ω, 1%
R656/756	6-102-12	1000 Ω
R657/757	6-102-12	1000 Ω
R658/758	6-102-12	1000 Ω
R659/759	6-222-12	2200 Ω
R660/760	NOT USED	
R661/761	6-105-12	1 MΩ
R662/762	6-222-12	2200 Ω
R663/763	6-102-12	1000 Ω
R664/764	6-102-12	1000 Ω

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
CAPACITORS		
C501	25-272	6000 μF electrolytic
C502	25-876	1000 μF electrolytic
C503	27-179	2 μF Mylar
C504	21-46	.005 μF ceramic
C505	21-140	.001 μF ceramic
C506	21-140	.001 μF ceramic
C507	21-140	.001 μF ceramic
C508	21-140	.001 μF ceramic
C509	25-832	100 μF electrolytic
C510	21-763	330 pF ceramic
C511	25-911	22 μF electrolytic
C512	27-77	.1 μF Mylar
C513	21-769	.01 μF ceramic
C526	21-769	.01 μF ceramic
C614/714	21-7	33 pF ceramic
C615/715	21-199	.1 μF ceramic
C616/716	21-140	.001 μF ceramic
C617/717	21-199	.1 μF ceramic
C618/718	25-179	2 μF electrolytic
C619/719	21-199	.1 μF ceramic
C620/720	21-7	33 pF ceramic
C621/721	21-7	33 pF ceramic
C622/722	21-140	.001 μF ceramic
C623/723	21-7	33 pF ceramic
C624/724	21-199	.1 μF ceramic
C625/725	25-816	15 μF electrolytic (non-polarized)
C626/726	NOT USED	
C627/727	21-769	.01 μF ceramic
C628/728	21-769	.01 μF ceramic
C629/729	21-769	.01 μF ceramic
C630/730	NOT USED	
C631/731	21-769	.01 μF ceramic
C632/732	21-769	.01 μF ceramic

SEMICONDUCTORS

See "Semiconductor Identification Charts."

MISCELLANEOUS

F501	421-3	2-ampere slow-blow fuse
L501	45-98	Choke

Head Drive Circuit Board
(Assembled #181-3264)

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION

RESISTORS

NOTE: All resistors are 1/4-watt, 5% unless marked otherwise.

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
R401	6-151-12	150 Ω
R402	6-151-12	150 Ω
R403	NOT USED	
R404	6-220-12	22 Ω
R405	6-471-12	470 Ω
R406	NOT USED	
R407	6-152-12	1500 Ω
R408	6-471-12	470 Ω
R409	6-201	200 Ω, 1/2-watt
R410	NOT USED	
R411	6-151-12	150 Ω
R412	3-52-5	1.5 Ω, 5-watt
R413	6-152-12	1500 Ω
R414	6-471-12	470 Ω
R415	6-201	200 Ω, 1/2-watt
R416	6-151-12	150 Ω
R417	3-52-5	1.5 Ω, 5-watt
R418	6-152-12	1500 Ω
R419	6-471-12	470 Ω
R420	NOT USED	
R421	6-201	200 Ω, 1/2-watt
R422	6-151-12	150 Ω
R423	3-52-5	1.5 Ω, 5-watt
R424	6-152-12	1500 Ω
R425	6-471-12	470 Ω
R426	6-201	200 Ω, 1/2-watt
R427	6-151-12	150 Ω
R428	3-52-5	1.5 Ω, 5-watt
R429	6-152-12	1500 Ω
R430	NOT USED	
R431	6-471-12	470 Ω
R432	6-201	200 Ω, 1/2-watt
R433	6-151-12	150 Ω
R434	3-52-5	1.5 Ω, 5-watt
R435	6-152-12	1500 Ω
R436	6-471-12	470 Ω
R437	6-201-	200 Ω, 1/2-watt
R438	6-151-12	150 Ω
R439	3-52-5	1.5 Ω, 5-watt
R440	NOT USED	
R441	6-152-12	1500 Ω
R442	6-471-12	470 Ω
R443	6-201	200 Ω, 1/2-watt
R444	6-151-12	150 Ω
R445	3-52-5	1.5 Ω, 1/2-watt
R446	6-152-12	1500 Ω
R447	6-471-12	470 Ω
R448	6-201	200 Ω, 1/2-watt
R449	6-151-12	150 Ω

Resistors (cont'd.)

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
R450	NOT USED	
R451	3-52-5	1.5 Ω, 5-watt
R452	6-152-12	1500 Ω
R453	6-471-12	470 Ω
R454	6-201	200 Ω, 1/2-watt
R455	6-151-12	150 Ω
R456	3-52-5	1.5 Ω, 5-watt
R457	6-220-12	22 Ω
R458	6-471-12	470 Ω
R459	6-332	3300 Ω, 1/2-watt
R460	NOT USED	
R461	6-332	3300 Ω, 1/2-watt
R462	6-332	3300 Ω, 1/2-watt
R463	6-332	3300 Ω, 1/2-watt
R464	6-332	3300 Ω, 1/2-watt
R465	6-332	3300 Ω, 1/2-watt
R466	6-332	3300 Ω, 1/2-watt
R467	6-332	3300 Ω, 1/2-watt
R468	6-332	3300 Ω, 1/2-watt
R469	6-103-12	10 kΩ
R470	NOT USED	
R471	6-470-12	47 Ω
R472	6-472-12	4700 Ω
R473	6-621-12	620 Ω
R474	6-471-12	470 Ω
R475	6-472-12	4700 Ω
R476	6-105-12	1 MΩ
R477	6-332-12	3300 Ω, 2-watt, 10%
R478	6-472-12	4700 Ω
R479	6-472-12	4700 Ω
R480	NOT USED	
R481	6-105-12	1 MΩ
R482	6-332-12	3300 Ω
R483	6-561	560 Ω, 1/2-watt
R484	6-102-12	1000 Ω

CAPACITORS

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
C401	25-197	1 μF tantalum
C402	21-762	.1 μF ceramic
C403	25-873	470 μF electrolytic
C404	NOT USED	
C405	27-77	.1 μF Mylar
C406	21-769	.01 μF ceramic
C407	21-769	.01 μF ceramic
C408	21-769	.01 μF ceramic

SEMICONDUCTORS

See "Semiconductor Identification Charts."

MISCELLANEOUS

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
F401	421-5	4-ampere slow-blow
SW401	65-19	Thermal circuit breaker switch

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Logic Circuit Board
(Assembled #181-3263)

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION

RESISTORS

NOTE: All resistors are 1/4-watt, 5% unless marked otherwise.

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
R201	6-681-1	680 Ω, 1-watt
R202	6-681-1	680 Ω, 1-watt
R203	6-221-12	220 Ω
R204	6-272-12	2700 Ω
R205	6-681-1	680 Ω, 1-watt
R206	6-681-1	680 Ω, 1-watt
R207	6-683-12	68 kΩ
R208	6-221-12	220 Ω
R209	6-220-12	22 Ω
R210	NOT USED	
R211	6-221-12	220 Ω
R212	6-122-12	1200 Ω
R213	6-561-12	560 Ω
R214	6-122-12	1200 Ω
R215	6-122-12	1200 Ω
R216	6-472-12	4700 Ω
R217	6-392-12	3900 Ω
R218	6-181	180 Ω, 1/2-watt
R219	6-181	180 Ω, 1/2-watt
R220	NOT USED	
R221	6-273-12	27 kΩ
R222	6-273-12	27 kΩ
R223	6-102-12	1000 Ω
R224	6-102-12	1000 Ω
R225	6-102-12	1000 Ω

RESISTOR MODULES

RP201	9-99	5@1000 Ω
RP202	9-99	5@1000 Ω
RP203	9-99	5@1000 Ω
RP204	9-99	5@1000 Ω
RP205	9-99	5@1000 Ω
RP206	9-99	5@1000 Ω
RP207	9-99	5@1000 Ω
RP208	9-99	5@1000 Ω
RP209	9-99	5@1000 Ω
RP210	NOT USED	
RP211	9-99	5@1000 Ω

CAPACITORS

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
C201	21-711	470 pF ceramic
C202	21-711	470 pF ceramic
C203	21-711	470 pF ceramic
C204	21-711	470 pF ceramic
C205	21-711	470 pF ceramic
C206	21-711	470 pF ceramic
C207	21-711	470 pF ceramic
C208	21-711	470 pF ceramic
C209	21-763	330 pF ceramic
C210	NOT USED	
C211	21-763	330 pF ceramic
C212	21-763	330 pF ceramic
C213	21-763	330 pF ceramic
C214	21-763	330 pF ceramic
C215	21-763	330 pF ceramic
C216	21-763	330 pF ceramic
C217	21-763	330 pF ceramic
C218	21-155	33 pF ceramic
C219	21-6	27 pF ceramic
C220	NOT USED	
C221	21-140	.001 μF ceramic
C222	21-769	.01 μF ceramic
C223	21-769	.01 μF ceramic
C224	21-769	.01 μF ceramic
C225	21-769	.01 μF ceramic
C226	21-769	.01 μF ceramic
C227	21-769	.01 μF ceramic
C228	25-883	47 μF electrolytic
C229	21-769	.01 μF ceramic
C230	NOT USED	
C231	21-769	.01 μF ceramic
C232	21-769	.01 μF ceramic
C233	21-769	.01 μF ceramic
C234	21-769	.01 μF ceramic
C235	21-769	.01 μF ceramic
C236	21-769	.01 μF ceramic
C237	21-769	.01 μF ceramic
C238	21-769	.01 μF ceramic
C239	21-769	.01 μF ceramic
C240	NOT USED	
C241	21-769	.01 μF ceramic
C242	21-769	.01 μF ceramic
C243	21-769	.01 μF ceramic

Logic Circuit Board (Cont'd.)

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
Capacitors (cont'd.)		
C244	21-769	.01 μF ceramic
C245	21-769	.01 μF ceramic
C246	NOT USED	
C247	21-769	.01 μF ceramic
C248	21-769	.01 μF ceramic
C249	21-769	.01 μF ceramic
C250	NOT USED	
C251	21-769	.01 μF ceramic
C252	21-769	.01 μF ceramic
C253	25-197	1 μF tantalum
C254	25-197	1 μF tantalum
C255	25-197	1 μF tantalum
C256	21-769	.01 μF ceramic
C257	21-769	.01 μF ceramic
C258	21-769	.01 μF ceramic

SEMICONDUCTORS

See "Semiconductor Identification Charts."

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
INDUCTORS		
L201	45-614	10.0 μH
L202	45-614	10.0 μH
L203	45-614	10.0 μH
L204	45-614	10.0 μH
L205	45-614	10.0 μH
L206	45-614	10.0 μH
L207	45-614	10.0 μH
L208	45-614	10.0 μH
L209	45-51	15 μH
L210	NOT USED	
L211	45-51	15 μH
L212	45-51	15 μH

MISCELLANEOUS

SW201	64-883	Pushbutton switch
SW202	60-621	8-section slide switch
SW203	60-621	8-section slide switch
SW204	60-621	8-section slide switch
Y201	404-623	6.7584 MHz crystal

Printer Unit

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
MISCELLANEOUS		
U1	150-74	Optical switch assembly
SW3	64-23	Microswitch
M2	420-612	Head drive motor
M3	420-614	Ribbon drive motor
	268-35	Belt
	266-1074	Print head assembly

Heathkit®

Paper Drive Unit

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION

LED — TRANSISTOR

See "Semiconductor Identification Charts."

MISCELLANEOUS

SW4	64-23	Microswitch
M1	420-613	Paper drive motor
	266-1076	Left tractor assembly
	266-1077	Right tractor assembly
	268-34	Belt

Electronics Unit

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION

RESISTOR

R1	6-472-2	4700 Ω, 2-watt, 5%

CAPACITORS

C1	21-140	.001 μF ceramic
C2	21-140	.001 μF ceramic
C3	21-140	.001 μF ceramic
C4	21-140	.001 μF ceramic
C5	25-807	7500 μF electrolytic

BRIDGE RECTIFIER

See "Semiconductor Identification Charts."

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION

MISCELLANEOUS

T1	54-986	Transformer
LF1	150-116	Line filter
SW1	60-642	Slide switch
SW2	61-43	Rocker switch
A1	401-63	Speaker
A2	420-620	Fan
F1	421-6	3-ampere slow-blow fuse

SPECIFICATIONS

GENERAL

The H-25 High Speed Printer is a high performance, dot matrix, impact, line printer.

PRINTING

Print Rate	152 CPS.
Thruput @ 10 cpi pitch	300 lines per minute when printing 10 column lines. 65 lines per minute when printing 132 column lines.
Print Head	Nine-wire impact dot matrix (wire diameter = .014 inches).
Matrix	9 × 9 for ASCII characters, 12 × 9 for graphics.
Horizontal Slew Rate	25 inches per second.
Drive Motor	Stepper motor.
Motion	Bi-directional.
Ribbon	Cartridge, with 3/4″ cloth continuous loop ribbon.

STANDARD CHARACTERS

Character Set	95 printable character ASCII, upper and lower case, with descenders and 33 block graphic characters.
Pitch	10, 12, 13.2, or 16.5 characters/inch (4, 4.7, 5.2, or 6.5 characters/cm) Pitch selection by either hardware or software, changeable only after a line terminator.
Maximum Characters Per 13.5″ Line	135, 162, 177, 222 depending on pitch.
Character Height	7 dot characters: 100″ (.04 cm). 9-dot characters: 128″ (.05 cm).
Character Width	Variable, depending upon pitch.
Vertical Line Spacing	6 or 8 lines per inch selectable by either hardware or software.

Heathkit®

PAPER HANDLING

Paper Types .... Standard edge-punched; single or multiple forms (maximum of 6), fanfold, 3.5″ to 17.78″ wide, with a maximum thickness of .018″.

Tractor Feed .... Quad tractor feed, with adjustable width.

Form Lengths .... 2″, 3″, 3-1/3″, 3-1/2″, 3-2/3″, 4″, 4-1/4″, 5″, 5-1/2″, 6″, 7″, 8″, 8-1/2″, 10″, 11″, 14″.

INTERFACE INFORMATION

Electrical .... Serial RS-232C or 20 mA current loop, with handshake control signals (reverse channel or busy signal).

Connector .... 25-pin male EIA connector; see Interface (Hardware) Requirements, Page 10, for pin identities.

Data Format .... Asynchronous bit serial, with 2 stop bits on 110 baud and 1 stop bit on all others.

Baud Rate .... 110, 150, 300, 600, 1200, 2400, 4800, 9600; hardware selectable

Line Buffering .... 256 characters.

Parity .... None, odd, even, or stick parity.

SERVICE DIAGNOSTICS

Print .... Generates and prints full ASCII character set and graphics without external connections.

Circuit Board Operation .... LED's indicate information activity at numerous places throughout circuitry.

PHYSICAL

Dimensions .... Approximately 26-1/2″W × 18-1/2″D × 8-1/4″H (67 × 47 × 21 cm).

Weight .... 62 pounds (28.1 kg).

Ambient Temperature
    Storage .... −40 to 60 degrees C.
    Operating .... 10 to 40 degrees C.

Power Requirements .... 100 to 135 volts or 200 to 270 volts, 50 to 60 Hz; 175 watts maximum, 60 watts standby.

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Appendix 1

HDOS Device Driver Patch

This patch modifies the current LPH24 device driver to work with the H-25 Line Printer. This modified driver does not support all of the H-25 features. However, an HDOS driver to fully support the H-25 will be released with future products. This patch will be made obsolete when the LPH25 driver is released.

Since the H-25 and H-24 are similar, the patch is minor and is identical for both the 2.0 and 1.6 HDOS LPH24 device drivers. The patch utility is used to patch HDOS system files. Functionally, this patch disables the incompatible escape sequences and toggles the polarity of the busy signal expected by the driver. The specific options eliminated are "length" and "LPI." Any user programs which need to set those values may explicitly transmit the appropriate H-25 escape sequence. To guard against accidental errors, the patch utility requires a "patch ID," prerequisite code, and "check code." These values, as well as the data values, should be entered as shown in the sample version. If any values are incorrect, the patch will abort the operation and it will be necessary to start over.

```
>pip lph25.dvd=lph24.dvd

1 Files Copied
>patch

PATCH Issue #50.06.00

File Name? lph25.dvd
Patch ID? ifojic
Prerequisite Code? ifbeiadpgeffcf
```

```
Address? 000375
000375 = 114/0
000376 = 105/0
000377 = 116/0
001000 = 107/0
001001 = 124/0
001002 = 110/0
001003 = 040/0
001004 = 040/0
001005 = 156/0
001006 = 011/0
001007 = 114/0
001010 = 151/0
001011 = 156/0
001012 = 145/0
001013 = 163/0
001014 = 057/0
001015 = 106/0
001016 = 157/0
001017 = 162/0
001020 = 155/0
001021 = 040/0
001022 = 133/0
001023 = 064/0
001024 = 055/0
001025 = 061/0
001026 = 061/0
001027 = 062/0
001030 = 135/0
001031 = 012/0
001032 = 114/0
001033 = 120/0
001034 = 111/0
001035 = 040/0
001036 = 040/0
001037 = 040/0
001040 = 040/0
001041 = 040/0
001042 = 156/0
001043 = 011/0
001044 = 114/0
```

```
001045 = 151/0
001046 = 156/0
001047 = 145/0
001050 = 163/0
001051 = 057/0
001052 = 111/0
001053 = 156/0
001054 = 143/0
001055 = 150/0
001056 = 012/0
001057 = 120/type Ctrl-D
Address? 001231
001231 = 114/40
001232 = 105/40
001233 = 116/40
001234 = 107/40
001235 = 124/40
001236 = 310/240
001237 = 001/type Ctrl-D
Address? 001316
001316 = 114/40
001317 = 120/40
001320 = 311/240
001321 = 003/type Ctrl-D
Address? 002113
002113 = 315/72
002114 = 130/type Ctrl-D
Address? 003123
003123 = 302/312
003124 = 101/type Ctrl-D
Address? type Ctrl-D
Patch Check Code? kdejnfpm

PATCH Issue #50.06.00

File Name? type Ctrl-D
>pip lp.dvd=lph25.dvd

1 Files copied
>bye
```

Appendix 2

H-25 Escape Sequence Information

Usually, you can mix text and escape sequences at will, but there are some rules you must follow to obtain predictable results.

Anything you send to the Printer is not printed or acted upon until the Printer receives a terminating character or reaches the right margin. Terminating characters are (ASCII mnemonics): CR, LF, FF, SI, VT, and DC4. Escape sequences which act as terminators are; ESC c and ESC M. A special case is the clear buffer escape sequence, ESC [2k, which eliminates the string awaiting a terminator rather than enabling the printing of it.

When an escape sequence is sent, it will not take effect until a terminating character is received, providing that the escape sequence is not itself a terminator.

All programming examples are given in HDOS MBASIC, and assume the following variable assignments:

    ESC$ = (CHR$(&33)   'escape char.
    CR$ = CHR$(&15)   'carriage return char.

    #1 (Open "O",#1,LP:)   n channel

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ACTION	DESCRIPTION	CHAR SEQ
RESET	Printer set to power-up configuration.	ESC c

1. Send print head home.
2. Double-width mode off.
3. Graphics mode off.
4. Horizontal tabs @ every 8 columns.
5. Vertical tabs at every line.
6. Right margin = max. for wide paper
   This last parameter depends on what the
   horizontal pitch dip-switches are set for:

   @10 CPI   — 135 CHARACTERS MAX.
   @12 CPI   — 162 CHARACTERS MAX.
   @13.2 CPI — 177 CHARACTERS MAX.
   @16.5 CPI — 220 CHARACTERS MAX.

The rear-panel dip-switches are read
for the following parameters:

1. Discard / Wrap at end of line mode.
2. Horizontal pitch.
3. Vertical pitch.
4. Form length.
5. Skip fold length.

NOTE: The only times the rear-panel switches
are read are at power-up, rear-panel reset,
and software reset.

BELL	Ring printer bell.	BEL (7Q)

The printer bell is rung immediately
when it is received; i.e., it does not go
into the printer buffer.

Example: (Rings the bell at the Printer)

PRINT #1, CHR$(&7);

Note that no terminator was required.

PRINT HEAD HOME

	Return head to left margin	SI (17Q)

DOUBLE WIDTH MODE

Enter double width mode.   SO   (16Q)

Must be FIRST character sent following a
terminator; i.e., it must be the first character
sent in a line. This mode is exited upon line
termination, so every where you want a double
width mode must start with "SO".

If you send this character at any time other
than at the beginning of a line, it will be ignored.

Note that, using double width mode, there are
effectively eight different character pitches
(2 × 4).

Example: (Prints a double-wide message.)

PRINT #1 SO$; "This is double width mode:

Note that the double width command is
THE VERY FIRST THING in the line.

REVERSE INDEX

Do a reverse line feed.   DC 4   (24Q)
                                                            ESC M

This acts as a terminator so it can
be sent to the printer at any time, and it
is also acted upon immediately.

One limitation on the use of the REVERSE INDEX:
The Printer will not reverse feed past the
top of the form.

Example: (Reverse line-feed two lines.)

PRINT #1, DC4$; DC4$;

Note the semicolon terminating this statement,
preventing BASIC from sending a CR-LF.

GRAPHICS MODE   Enter graphics character mode.   ESC [10m

In the graphics mode, all lower-case alphabetic
characters plus seven other ASCII characters
are printed as graphics characters. (The
graphics character set is documented elsewhere
in the manual.)

Example: (Enters graphics mode, prints bar.)

PRINT #1, ESC$; "[10m"; CR$;
PRINT #1, "iiiiiiiiii"

Note the Carriage-Return terminator following
the graphics mode escape sequence.

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NON-GRAPHICS MODE

    Exit the graphics character mode.   ESC [11m

DISCARD MODE   Discard at end of line.   ESC [?7h

    In this mode, any text sent which would
    extend beyond the right margin setting
    is discarded.

WRAP-AROUND MODE

    Wrap at end of line.   ESC [?7l

    In this mode, any text sent which would extend
    beyond the right margin setting is printed
    on the next line.

HORIZONTAL PITCH

    Set horizontal character pitch

10	CPI	ESC [w
		ESC [0w
		ESC [1w
12	CPI	ESC [2w
13.2	CPI	ESC [3w
16.5	CPI	ESC [4w

    Remember, when you use the double-width mode,
    there are really eight different pitches.

    Example: (Messages in the eight pitches.)

```
PRINT #1, ESC$; "[1w;    CR;
PRINT #1, SO$; "This is 5 CPI"
PRINT #1, ESC$; "[2w";    CR$;
PRINT #1, SO$; "This is 6 CPI"
PRINT #1, ESC$; "[3w";    CR$;
PRINT #1, SO$; "This is 6.6 CPI"
PRINT #1, ESC$; "[4w;    CR$;
PRINT #1, SO$; "This is 8.25 CPI"
PRINT #1, ESC$; "[1w";    CR$;
PRINT #1, "This is 10 CPI"
PRINT #1, ESC$; "[2w";    CR$;
PRINT #1, "This is 12 CPI"
PRINT #1, ESC$; "[3w;    CR$;
PRINT #1, "This is 13.2 CPI"
PRINT #1, ESC$; "[4w";    CR$;
PRINT #1, "This is 16.5 CPI"
```

    Note the terminating Carriage-Returns after
    each escape sequence, and the double width
    command being first in the lines it's used.

VERTICAL PITCH

Set vertical line pitch

6 LPI	ESC [x
	ESC [0x
	ESC [1x
8 LPI	ESC [2x

In graphics mode, the eight LPI pitch should be
used for vertically adjacent characters.

HORIZONTAL TABS

Set / Clear horizontal tabs.

The term "active column" used below means the next
available character position. . .

Set tab @ active column.   ESC H
                                                            ESC 1

Clear tab @ active column.   ESC [g
                                                            ESC [0g

Set tabs @ every eight columns   ESC [t
(clears any other tabs).

Set tabs @ selected columns (max. 20)   ESC [~~T1;T2;Tn~~u *Pn; Pn; Pnu*
~~T1, T2,. . . . Tn~~ *Pn; Pn;.... Pnu*

Clear tabs @ selected columns (max. 20)   ESC [~~T1;T2;Tn~~u *Pn; Pn; Pnv*
~~T1, T2,. . . . Tn~~ *Pn; Pn;.... Pnv*

Clear all tabs.   ESC [2g
                                                            ESC [3g
                                                            ESC 2

Example; (Sets 5 tabs.)

PRINT #1, ESC$; "[6; 12;24;48;96u";   CR$;

Again, note the terminator following the escape sequence.

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VERTICAL TABS   Set / Clear vertical tabs.

"Active line" used below means the next
available new line. . .

Set tab @ active line.	ESC J
	ESC 3
Clear tab @ active line.	ESC [r
	ESC [0r
Set tabs @ every line.	ESC [4r

Set tabs @ selected lines (max. 20)
L1, L2,. . . Ln   *Pn; Pn; ... Pnp*   ESC [~~L1;L2;Lnp~~   *Pn; Pn; Pnp*

Clear tabs @ selected lines (max. 20)
L1, L2,. . . Ln   *Pn; Pn; ... Png*   ESC [~~L1;L2;Lnq~~   *Pn; Pn; Png*

Clear all tabs.	ESC [2r
	ESC [3r
	ESC [4

Example: (Sets 5 tabs.)

PRINT #1, ESC$; "[5;10;20;40;60p";   CR$;

And again, note the terminating Carriage-Return.

SKIP FOLD   Set number of lines for skip fold.

0 lines	ESC [z
	ESC [0z
2 lines	ESC [1z
4 lines	ESC [2z
6 lines	ESC [3z

Example: (3 line margins top and bottom.)

PRINT #1, ESC$; "[3z;   CR$;

Note the Carriage-Return terminating this
escape sequence.

RIGHT MARGIN   Set right margin.

"Pn"   ESC [; Pns

"R" = 220 max.   ~~ESC [0;Rs~~

At power-up or after a software RESET, the
right margin is set as documented under RESET above.

If the programmer chooses different pitches after
a RESET, the right margin setting isn't changed;
i.e., the physical width of the right margin
changes inversely with the change in pitch.

Therefore, the programmer must maintain the right
margin setting whenever different pitches are being used.

Remember, the Printer really has eight pitches,
using double width mode — the additional four
pitches obtained using double width mode are treated
the same as the standard four concerning margin
calculation, etc.

Example: (Set long right margin.)

PRINT #1, ESC$; "[;220s";   CR$;

Note the terminating character.

CLEAR BUFFER   Delete unterminated information from buffer ESC [2K.

FORM LENGTH   Set physical form length.

11″	form	ESC [y
		ESC [0y
14″	form	ESC [1y
10″	form	ESC [2y
8.5″	form	ESC [3y
8″	form	ESC [4y
7″	form	ESC [5y
6″	form	ESC [6y
5.5″	form	ESC [7y
5″	form	ESC [8y
4.25″	form	ESC [9y
4″	form	ESC [10y
3.67″	form	ESC [11y
3.5″	form	ESC [12y
3.33″	form	ESC [13y
3″	form	ESC [14y
2″	form	ESC [15y

Example: (Select 2″ form size.)

PRINT #1, ESC$; "[15y", CR$;

Once again, note the terminating character.

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
                    Benton Harbor
                    MI 49022
                    Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH ZENITH

New Orleans —
504-467-6321